[H.A.S.C. No. 111–182]

FIGHTING SUPERBUGS: DOD'S RESPONSE TO MULTIDRUG-RESISTANT INFECTIONS IN MILITARY TREATMENT FACILITIES

HEARING

BEFORE THE

SUBCOMMITTEE ON OVERSIGHT AND INVESTIGATIONS

OF THE

COMMITTEE ON ARMED SERVICES
HOUSE OF REPRESENTATIVES

ONE HUNDRED ELEVENTH CONGRESS

SECOND SESSION

HEARING HELD
SEPTEMBER 29, 2010

U.S. GOVERNMENT PRINTING OFFICE
62–994 WASHINGTON : 2010

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FIGHTING SUPERBUGS: DOD'S RESPONSE TO MULTIDRUG-RESISTANT INFECTIONS IN MILITARY TREATMENT FACILITIES

HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
SUBCOMMITTEE ON OVERSIGHT AND INVESTIGATIONS,
Washington, DC, Wednesday, September 29, 2010.

The subcommittee met, pursuant to call, at 1:30 p.m., in room 2118, Rayburn House Office Building, Hon. Vic Snyder (chairman of the subcommittee) presiding.

OPENING STATEMENT OF HON. VIC SNYDER, A REPRESENTATIVE FROM ARKANSAS, CHAIRMAN, SUBCOMMITTEE ON OVERSIGHT AND INVESTIGATIONS

Dr. SNYDER. Good afternoon, and welcome to the Subcommittee on Oversight and Investigations' hearing on the Defense Department's efforts to monitor and control outbreaks of multidrug-resistant infections that have occurred in military hospitals over the past several years.

While the U.S. military has provided high-quality healthcare for servicemembers wounded in Iraq and Afghanistan, infection outbreaks caused by multidrug-resistant bacteria emerged as a problem early on during military operations. One of the pathogens with the most notoriety is *Acinetobacter baumannii*—incidentally, any pronunciations are my own and any resemblance to accurate pronunciations is clearly coincidental, so—*Acinetobacter baumannii*, a group of opportunistic bacteria which can accumulate antibiotic resistance relatively quickly. The only treatments available to fight the infections, in some cases, are highly toxic, older drugs that can cause harm to a patient's health.

According to the DOD [Department of Defense], over 3,300 servicemembers developed *Acinetobacter* infections from 2004 to 2009. While the bacteria are found in the natural environment, evidence suggests that the source of infections was in the military hospitals. Contamination in these hospitals placed other patients at risk. Outbreaks of multidrug-resistant infections have created management challenges for the military.

Initially, the source of infections was difficult to identify because wounded personnel are evacuated to several treatment facilities before reaching a medical center in the United States. Also, determining the nature and extent of the problem took time because infections did not show up in patients until days after injury, and screening and surveillance capabilities were limited.

Moreover, implementing infection control and prevention measures in combat hospitals are challenging given the physical condi-

tions and limited infrastructure available. The lack of infection control expertise at these facilities, as well as limited experience in treating multidrug-resistant infections compounded efforts to manage outbreaks.

In the past few years, the number of infections in military hospitals has decreased significantly, in part because the total number of combat casualties has gone down, but also because DOD and the services have implemented measures to strengthen infection screening, control, and prevention in the military healthcare system. Steps have been taken to promote awareness of basic infection control practices such as using new gloves and gowns with each patient. Guidelines for isolating patients with suspected multidrug-resistant infections and more targeted use of antibiotics were implemented. Additional infection control training is now available to deploying medical personnel. Furthermore, standardized screening for multidrug-resistant bacteria has been instituted at the major military medical centers.

Lastly, research has been conducted, which has led to a better understanding of the risks and treatments associated with multidrug-resistant infections.

While considerable progress has been made in controlling infections, the problem has not been solved and new outbreaks will be a continuing challenge. According to some service officials, there is a need for (1) a more comprehensive surveillance system to monitor infections; (2) enhanced training and expertise in infection control; (3) a coordinated and sustained approach in research and development; and (4) perhaps an infection control consultant in each combat theater.

The incidence of drug-resistant infections is a national and global problem in both the civilian and military world that has grown dramatically over the past decade in civilian hospitals. According to the Centers for Disease Control and Prevention, almost 100,000 Americans are killed each year by hospital-acquired infections. Health experts warn that the problem could get worse in the next several years because there are few new antibiotic treatments expected from the drug research pipeline. Because patients with severe injuries are most susceptible to these infections, DOD and the services must remain vigilant in their efforts to monitor and prevent them.

The purpose of this hearing is to examine how the Department of Defense has responded to outbreaks of multidrug-resistant infections over the past several years and whether effective surveillance, prevention, and research programs are in place to manage this challenge in the future, and what Congress can do to help.

That concludes my opening statement.

Congresswoman Louise Slaughter has had an interest in this issue of multidrug-resistance for some years now. I would ask unanimous consent to include as an addendum to my opening statement, a statement from Representative Slaughter.

[The prepared statement of Ms. Slaughter can be found in the Appendix on page 31.]

Dr. SNYDER. And I will now recognize Mr. Wittman for any comments he would like to make.

STATEMENT OF ROB WITTMAN, A REPRESENTATIVE FROM VIRGINIA, RANKING MEMBER, SUBCOMMITTEE ON OVERSIGHT AND INVESTIGATIONS

Mr. WITTMAN. Well, thank you, Chairman Snyder. And good afternoon to our witnesses. Thank you so much for joining us today and thank you for your service to our country.

You know, it is easy to start a debate or to find a contrary view on almost every issue that arises here in Washington. The good news is that the subject of today's hearing is that rare exception to the rule. You know, there is no political party, no healthcare provider and certainly no patient that wants any part of infection, much less the virulent infections that are the subject of today's hearing.

Multidrug-resistant organisms, or MDROs, are a serious matter for both our military and civilian healthcare providers and are with us to stay, I fear.

I understand that infection control demands constant vigilance in medical facilities, requiring careful training and strict adherence to proper procedures within all areas of military treatment facilities. Infection control is particularly difficult in an austere deployed setting with limited supplies, limited access to fresh water, and the necessity of handling potentially large numbers of casualties who have been living in a field environment.

I traveled last spring to Afghanistan and after a single day was covered in a significant layer of dust. So I can tell you after moving through Kandahar Province, I have a deep appreciation for what you all have to deal with downrange. And I can only imagine the condition of troops living in the field for months at a time, just based on my short experience there.

So I know infection control under such circumstances must be daunting. And we are all glad to see that the growing problem of Gram-negative bacterial infections in military facilities was identified several years ago, and that considerable progress has been made in screening for and controlling these infections. In fact, the number of cases of the most virulent bacteria was cut by almost two-thirds of military facilities from the peak. My hat is off to you on that.

Still, improvements can be made in enforcing infection control protocols and reporting mechanisms and in research for both the better treatment and better control procedures.

We on the committee fully support your efforts in this area, and I look forward to hearing from you on how we can help to continue to make progress in combating infections of all types.

I look forward to your testimony today. And again, thank you so much for what you have done. And thank you in the future for what you will do in addressing this daunting issue.

And, Mr. Chairman, with that I yield back.

[The prepared statement of Mr. Wittman can be found in the Appendix on page 29.]

Dr. SNYDER. Thank you, Mr. Wittman.

Our witnesses today are Dr. Jack Smith, the Acting Deputy Assistant Secretary for Clinical and Program Policy, Office of the Assistant Secretary of Defense for Health Affairs; Colonel/Dr. Jonathan Jaffin, Director, Health Policy and Services, Office of the

Army Surgeon General; Colonel/Dr. Duane Hospenthal, Infectious Disease Consultant to the Army Surgeon General and Chief of Infectious Disease Service at Brooke Army Medical Center; Colonel/Dr. James D. Collier, Assistant Air Force Surgeon General for Health Care Operations; Lieutenant Colonel/Dr. Michael Forgione, Infectious Disease Consultant to the Air Force Surgeon General and Chief of Medicine at Keesler Air Force Medical Center; Captain/Dr. Gregory Martin, Infectious Disease Consultant to the Navy Surgeon General and Program Director of the Infectious Disease Clinical Research Program at the Uniformed Services University of the Health Sciences; and Ms. Judith English, Navy Bureau of Medicine and Surgery Infection Control Consultant.

Thank you all for being here. We will—somewhere we have a clock that you can see. We will turn the clock on for five minutes. When the red light starts flashing, it means five minutes have gone by. If you have more things to say, let us know. Otherwise, we will get to our questions. We have seven witnesses but only four of you actually are doing opening statements. And we will begin with you, Dr. Smith.

STATEMENT OF DR. JACK SMITH, ACTING DEPUTY ASSISTANT SECRETARY FOR CLINICAL AND PROGRAM POLICY, OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE FOR HEALTH AFFAIRS

Dr. SMITH. Thank you, sir. Chairman Snyder, Ranking Member Wittman, members of the committee, thank you for the opportunity to discuss Department of Defense efforts to address the growing challenge of healthcare-associated infections, particularly those from multidrug-resistant organisms, or MDROs.

We greatly appreciate the committee's interest in this important issue and its continued strong support for the dedicated men and women of America's Armed Forces.

Mr. Chairman, as the committee so well understands, healthcare-associated infections, including those from MDROs, are a serious problem for the military but also represent a growing problem in healthcare facilities across the Nation. These pathogenic organisms, which are predominantly bacteria, have not only increased the length of hospital stays but also mortality rates. So the problem is quite serious and one that we must continue to address.

The sources of these bacteria and infections are multifactorial with both environment and facility-related factors. In hospital settings, they are most likely to contaminate environmental surfaces, equipment such as ventilators and dialysis machines, the hands of healthcare workers, visitors and family members, and the respiratory, urinary, skin, and gastrointestinal tracks and wounds of hospitalized patients.

Accumulated data have shown that transmission of MDRO infections in combat-wounded servicemembers who have returned to the U.S. does not appear to have a single source or involve a single strain of bacteria but, rather, are derived from multiple sources and must be addressed as system issues.

DOD has been actively engaged in measures to screen, surveil, prevent, and control infections in military treatment facilities at

home and on the battlefield. The military health system maintains a quality assurance program implemented in all military treatment facilities that establishes policies and procedures and requires training of our personnel to minimize the risk of infection to patients and staff, control the spread of infection, assess patient care, review healthcare records, and manage health resources and risk.

We have also established an Infection Prevention and Control Panel with service subject matter experts as a subcommittee of our Military Health System Quality Forum. The Global Emerging Infection Surveillance and Response System, a division of the Armed Forces Health Surveillance Center, is a central hub that leverages the surveillance and response assets of the services and oversees military medical research units and is paving the way for laboratory standardization for microbes of military interest.

The Multidrug-Resistant Organisms Repository and Surveillance Network System, established by the Medical Research and Materiel Command, is working to rapidly characterize emerging drug-resistant threats, track and monitor MDRO patients, and reduce the risk of healthcare-associated infections, which will aid in the development of a daily alert surveillance system for MDROs of significant importance.

Since December of 2008, the military health system has been participating in the Centers for Disease Control's national healthcare safety network. Currently, 33 of our military treatment facilities are participating. We are also participating in the American College of Surgeons National Surgical Quality Improvement Program, or NSQIP, which is focusing on, among other issues, the occurrence of surgical-site infections which could involve MDROs. And the Joint Theater Trauma Registry is adding an infectious disease module to study and better understand the risks, interventions, and outcomes associated with combat trauma.

Standard infection prevention and control practices and standard clinical practice guidelines have been established and implemented in both garrison military treatment facilities and deployed areas.

Admission MDRO colonization screening is performed at the four major receiving military medical centers for OEF [Operation Enduring Freedom] and OIF [Operation Iraqi Freedom] wounded: Landstuhl Regional Medical Center, Walter Reed Army Medical Center, National Naval Medical Center, and Brooke Army Medical Center. Patients are not released from contact precautions or isolation until they screen negative. And screening results are collected, reviewed, and reported.

And DOD partnerships have been established with the VA [Veterans Administration] and the CDC [Centers for Disease Control] to address the challenges presented by MDRO and other infections. In addition to screenings, surveillance, prevention, and control, DOD has numerous studies underway to further our understanding of MDRO and other infections to enhance the prevention and control of infections and develop new treatments and therapeutics. Several DOD research laboratories receive funding to conduct research on MDROs, including Walter Reed Army Institute of Research, U.S. Naval Research Laboratory, U.S. Navy Medical Research Center, the Institute of Surgical Research, the Armed

Forces Institute of Pathology, and the four major medical centers already mentioned.

Mr. Chairman, the Department shares the committee's concerns about the threat of multidrug-resistant organisms and we are working to improve our preventive measures, treatment, surveillance, and research as we respond to outbreaks of MDRO and other infections in military personnel and facilities.

We appreciate the committee's interest in this important issue and I will be happy to respond to any questions you may have.

[The prepared statement of Dr. Smith can be found in the Appendix on page 34.]

Dr. SNYDER. Thank you, Mr. Secretary.

Colonel Hospenthal, I think you are next. You are recognized.

STATEMENT OF COL. DUANE HOSPENTHAL, USA, M.D., OFFICE OF THE SURGEON GENERAL, INFECTIOUS DISEASES CONSULTANT

Colonel HOSPENTHAL. Chairman Snyder, Representative Wittman, members of the committee, thank you for this opportunity to discuss how the U.S. Army operates to prevent and treat multidrug-resistant organism infections.

As you have already pointed out, multidrug-resistant organisms have increasingly become a healthcare threat in the U.S. and throughout the world. Focus in the U.S. and abroad to control these infections has included attempts to prevent transmission within our hospitals and other healthcare settings. These efforts have been championed by the Joint Commission through patient safety goals, and by the Centers for Disease Control and Prevention through guidelines and the prevention of MDROs.

Since the onset of Operations Iraqi Freedom and Enduring Freedom, infections and colonizations with MDROs, especially MDR *Acinetobacter* and the extended spectrum beta-lactamase producing *E. coli* and *Klebsiella*, have complicated the care of our injured U.S. military personnel. The source of these bacteria in returning combat-injured personnel has not been fully elucidated, but it appears that most likely these bacteria are spread nosocomially, both in the combat theater, along the journey back to, and within, military medical centers in the United States.

In addition to routine practices and participation and U.S. civilian healthcare standards, which I have mentioned, the military healthcare system has responded to the problem with specific efforts focusing on ameliorating the problem in returning injured personnel. And these efforts include the admission MDRO screening, which Dr. Smith has discussed; development of specific guidelines to prevent infections in the combat injured; efforts to improve infection prevention and control in the combat theaters; establishment of an MDRO repository and surveillance network; and enhanced research efforts.

Admission MDRO colonization screening is performed, as mentioned, in the four major receiving medical centers. Patients are not released from contact isolation until they screen negative. This provides near real-time monitoring in the rates of this colonization and potential infections in evacuated personnel to feed back to the combat theater.

Clinical practice guidelines, developed by a consensus conference including the Army, Air Force, Navy, and civilian personnel have been produced and promoted. These guidelines for the prevention of infection after combat-related injuries have focused on limiting antibiotic overuse and basic infection control interventions in theater.

Critical review of infection control practices and challenges in the combat theater hospitals was conducted by myself and Colonel Helen Crouch in 2008 and 2009. These reviews produced multiple interventions to improve our infection control in a deployed setting. And this includes a renewed emphasis and focus on basic infection control methodologies and practices; development of electronic resources and Web pages; deployment of clinical microbiology and antibiotic control; as well as the establishment at the Army Medical Department Center and School, a short five-day course for identified infection control officers for deployed Level III hospitals.

Also a standardized infection control policy was produced and is being staffed currently in the Afghanistan theater.

The repository established to collect and study MDROs was established in June of 2009. The MDRO Repository and Surveillance Network, the MRSN, was established to collect and characterize bacterial isolates and provide epidemiological data to manage this problem. In conjunction with clinical and transportation data, the MRSN could help localize sources of MDROs to enhance and focus infection control methods. And data from the Joint Theater Trauma Registry will be essential to this effort.

Over the past several years, the DOD has enhanced and expanded research in the prevention and treatment of MDROs. The Army is committed to aggressive efforts to prevent and treat MDRO infections. This includes a commitment to continue research aimed at understanding, preventing, and treating these infections. Additional efforts are underway to prevent transmission of MDROs within our military hospitals. We join civilians and other Federal agencies in our commitment to combat the spread of MDRO infections.

Thank you again for this opportunity to address the Army's efforts. And thank you for your continued support to our Nation's soldiers.

[The prepared statement of Colonel Hospenthal and Colonel Jaffin can be found in the Appendix on page 45.]

Dr. SNYDER. Thank you. Captain Martin.

STATEMENT OF CAPT. GREGORY MARTIN, USN, M.D., PROGRAM DIRECTOR, INFECTIOUS DISEASE CLINICAL RESEARCH PROGRAM

Captain MARTIN. Chairman Snyder, Congressman Wittman, distinguished members of the subcommittee, I am pleased to have the opportunity to update you on Navy Medicine's response to the problem of multidrug-resistant organisms.

As the Navy Surgeon General specialty leader for infectious diseases and a practicing infectious disease physician at Bethesda Naval Hospital, I can assure you this issue is vitally important to the Vice Admiral Adam Robinson and to all of Navy medicine.

One only has to listen to NPR [National Public Radio] or watch the evening news to understand that the threat from multidrug-resistant organisms has really become a global issue. The Infectious Disease Society of America, the Institute of Medicine, and the World Health Organization have all identified resistant infectious agents as major public health threats for which a coordinated global effort is urgently needed.

The DOD has been a national leader in identifying and addressing the MDRO challenge. While focused on the combat injured, many of whom have survived overwhelming blast injuries with burns and amputations, the reality of treating these infections has been sobering. In some cases, MDRO infections have been responsible for persistent infections, leading to delayed healing, amputations, or sepsis.

MDRO infections in our combat injured were first identified in 2003 on the hospital ship *Comfort* and at Bethesda. The Naval Hospital began screening of OEF/OIF patients for MDROs and instituted infection control measures to prevent their acquisition and transmission among patients and staff. Bethesda screening was then adopted in each of the major casualty screening centers in the U.S. and in Landstuhl.

Our Army colleagues deployed an expert team to treatment facilities in theater to assess infection control measures and ensure that standard precautions were being adhered to, even in forward treatment areas. Their efforts led to changes in practice in all three services with cohorting of long-term patients separately from the acutely injured patients who were unlikely to harbor MDROs and were typically being MedEvac'd back to Landstuhl and CONUS [continental United States] Army and Navy facilities.

Furthermore, infection control training needs were identified and a predeployment infection control course made available to each of the services.

The establishment of the MDRO repository and surveillance network to collect isolates will enable a more definitive molecular analysis of the relationships among the MDROs, as well as common sources for their acquisition. As our patients transfer between hospitals of the different services, all DOD MTFs [Military Treatment Facilities] will benefit from the repository system.

Most importantly, our patients, their families, and our clinicians would like to know what can be done to limit the harm these infections inflict on our wounded warriors. In this regard, Navy BUMED [Bureau of Medicine] has funded the Trauma Infectious Disease Outcome Study, or TIDOS, to combine surveillance, laboratory, and clinical data from combat-injured patients and follow them through their subsequent care in VA hospitals.

The DOD is uniquely capable to develop a program like TIDOS that can monitor a large group of patients and develop evidence-based recommendations that will be utilized not only in the care of an injured marine from Afghanistan but also the high school student with an infection after a car accident.

In the last few weeks, the TIDOS project has expanded to include the VA hospitals, and is now one of the first medical programs to bridge the military to the VA transition. We are enthusiastic that TIDOS will provide the data to assess our treatment of

combat-related infections and effect changes in practice that will improve future outcomes.

Overall, I feel the response of the DOD infectious diseases and infectious control communities to the worldwide threat of MDROs is something we should be proud of. Careful surveillance, coordinated interventions, and increased research efforts are helping the Navy and the DOD to remain at the forefront in the response to MDROs.

I appreciate the opportunity to have updated you on our efforts and look forward to your questions. Thank you.

[The prepared statement of Captain Martin and Ms. English can be found in the Appendix on page 52.]

Dr. SNYDER. Thank you, Captain Martin. Colonel Collier.

STATEMENT OF COL. JAMES D. COLLIER, USAF, M.D., ASSISTANT SURGEON GENERAL, HEALTH CARE OPERATIONS, OFFICE OF THE SURGEON GENERAL

Colonel COLLIER. Chairman Snyder, Representative Wittman, good afternoon and thank you very much for this opportunity to discuss this critical issue with you today.

The Air Force is working diligently with our sister services to control infectious diseases in theater and in our medical treatment facilities. As you are well aware, this problem continues to challenge the medical community in both the public and private sectors around the globe. And we appreciate your support in our endeavors to address it.

As I am the last to speak, I will try not to be redundant to the previous witnesses, and have submitted my full statement for the record.

In response to the challenge of treating and managing MDRO infections in our returning servicemembers, the DOD has instituted coordinated Tri-Service efforts in the areas of infection control and prevention, in surveillance, and in research and development.

I will speak briefly about Air Force infection control initiatives. The Air Force is committed to infection control throughout our continuum of care. The most common patients in our Air Force theater hospitals to develop MDRO infections are those who remain in intensive care units for extended periods of time. Active Duty ICU patients are stabilized and sent to Landstuhl Regional Medical Center or CONUS hospitals as quickly as possible.

In contrast, injured and ill host-nation patients have very limited resources for long-term medical care within their country; thus they tend to stay longer in our theater hospitals. This population is the one most susceptible to MDRO infection and colonization.

Our theater hospitals have a physician and nurse as the infection control officer and representative to provide ongoing oversight and promote continuing awareness of infection control standards. They conduct surveillance, provide educational briefings on antibiotic-resistance issues and wound management, and emphasize basic infection control efforts to prevent spread between hospitalized patients throughout the deployment rotation.

The Air Force also has a specific package, the expeditionary infectious disease team, which is available to provide dedicated infectious disease and infection control assets for the theater surgeon.

As the primary source of patient transportation from theater hospitals to Landstuhl and back to and throughout CONUS, air medical evacuation [AE] is the linchpin of our healthcare continuum.

Our AE crews are trained annually in infection control. In addition to the usual standard precautions, crews are trained to mitigate the risk of transmitting nosocomial infections in the operational environment. They are trained to disinfect equipment and have in-flight kits that contain both spill kits and personal protective equipment. Further, hand sanitizers are placed throughout the aircraft cabin. AE personnel are also educated about airflow in our different air frames and where best to position patients to avoid the spread of infection.

The Air Force has formal infection control courses that are conducted at Sheppard Air Force Base in Texas. There are three levels of training provided: for those assigned to infection control positions, both officer and enlisted on the active duty side; for those assigned as the infection control function and committee chairperson; and training specific for our reserve component members.

We also utilize equivalent civilian infection control courses. The new draft of our Air Force instruction, entitled "Infection Prevention and Control Program" has added an optional element, which suggests that an active duty officer serve as an infection control assistant and rotate through the infection control office in those facilities that have a civilian infection preventionist assigned. This is designed to facilitate actual hands-on management of the infection control program in garrison for active duty officers so they may gain experience prior to deploying.

While none of our Air Force MTFs consistently receive combat-injured U.S. personnel at this time, our medics do practice in all of the major MTFs responsible for the care of these patients, which include forward-based hospitals and, as I mentioned, in our air and medical evacuation system.

An MDRO colonization screening process of OIF and OEF wounded, upon admission, is now in place; and, encouragingly, a recent review of this data has shown a significant decrease in the number and percentage of patients colonized with *Acinetobacter* upon arrival at Landstuhl and the three Level V CONUS facilities.

While much remains to be done and understood to control or eliminate this complex medical dilemma, we continue to work with the world's foremost infectious disease experts to find the answers that will prevent future patients from contracting an infectious disease from others in the very environment designed to protect and heal them.

Whether they are our military and family members here in CONUS or our wounded warriors in theater, we must find a solution to this constantly evolving challenge.

We appreciate your support, Mr. Chairman, and that of the committee as we seek to achieve this daunting but critical goal. Thank you.

[The prepared statement of Colonel Collier and Colonel Forgione can be found in the Appendix on page 63.]

Dr. SNYDER. Thank you all. I thank you all for being here.

Colonel Collier, I think you were the only person brave enough to try your own pronunciation of *Acinetobacter*. So we applaud you

for that. You know—well, Mr. Wittman, I will put ourselves on the 5-minute clock, whoever the timekeeper is here.

When you think about what this means for families and individuals who have been wounded, moved to a military facility in country, moved to Landstuhl, come back to the United States, get put into one of our military hospitals, have family members probably down there by then, and then to develop one of the infections and have things go south very rapidly, it must be just heartbreaking not only for the family but also for the healthcare providers that are trying to take care of this person.

And, Dr. Smith, I will ask you the question but then I will let you defer to whoever you want to. I would like a little tutorial, if I could get one, on IED [improvised explosive device] injuries, and if the fact of a blast effect, in addition to an open wound, how that—if that is a factor in these infections.

Dr. SMITH. Well, sir, I am certainly not an expert on IED injuries. But as we all know, they have become quite a problem for us in DOD during the course of this war. I believe we do have Colonel Hospenthal who could perhaps respond to that.

Colonel HOSPENTHAL. Sure. I mean, certainly the blast injuries from IEDs cause tremendous tissue damage and devascularization. Initially when we were looking for a source of these MDROs, we were concerned whether there are—some of the bacteria in the soil and organic debris were actually being lodged up in organic fragments and such. And so certainly it doesn't look like that is the main cause of these MDRO infections, but certainly the damage is. The damage that is caused there has to be carefully debrided while trying to save tissue, and so devitalized tissue may need the—the surgeons may need to go back multiple times to try to debride off the dead parts of the tissue, to allow the vascularized surviving tissues to survive, all during the while there is pressure from—or colonization with bacteria, like we have bacteria always on our bodies. And in the hospitalized environment, these bacteria are all off in these multidrug-resistant bacteria that then colonize these wounds and can cause the infections that we see.

Dr. SMITH. And, Colonel Jaffin, you have some comments concerning this.

Colonel JAFFIN. Sir, I guess I am the only surgeon at the table. But what we see, especially with the large blast injuries, is a lot of separation of tissue along the tissue planes, that there is disruption of the vascular supply leading to large amounts of tissue. And so in order to minimize deformity and dysfunction, we try and preserve as much of that tissue as we can.

At the same time, we are caught trying to make sure that we remove all of the tissue that is not viable. That nonviable tissue is a great culture medium for any organism. And that is why the importance of the drug—of the infection control measures to prevent colonization with the multidrug-resistant organisms.

Dr. SNYDER. In terms of the availability of research dollars, you all have your own budgets, and we have a lot of activity going on with NIH [National Institutes of Health]. I don't have a sense of the adequacy of research dollars available to you all for looking at this issue. Is it adequate? Is it inadequate? It seems like it actually went down over the last couple of years. This is in the area where

Congress can help. If we are not doing our job, you won't have adequate research dollars.

Dr. Smith or anyone else want to comment?

Dr. SMITH. Yes, sir. I will begin with what is budgeted at the DOD level. We have currently in this fiscal year $13.68 million allocated for studies related to multidrug-related organisms or multidrug-resistant organisms—I am sorry—$10.25 of that in antimicrobial countermeasures and $3.43 of that in wound infection prevention and management. And the other—the services do allocate some research dollars I believe as well to MDROs and infectious-disease issues. And I will let the services speak to those.

Dr. SNYDER. I think that is your cue.

Dr. SMITH. Do you have figures for Army, MIDRP [Military Infectious Diseases Research Program] or——

Colonel JAFFIN. I can probably take that, sir. For MIDRP, there is about $430,000. For the specific on wound infections, there is $895,000. U.S. Navy wound infection research also gets money. I don't have the exact number right here. USUHS [Uniformed Services University of the Health Sciences] has a little over $4 million. For congressional special interest projects on wound infection, there is almost $12 million. SBIR [Small Business Innovation Research] project is about $3.7 million.

Dr. Smith spoke about the Defense health programs and then war supplemental intermural projects, there is about another $2.5 million, sir.

Dr. SNYDER. Anyone else have any comment?

Dr. Smith, I thought that the upcoming year—you said out of the current fiscal year—I thought the upcoming estimate is actually going to be a drop of several million dollars, from almost $14 million; is that correct?

Dr. SMITH. Sir, I don't have figures for fiscal year 2011 or beyond at this point. It is my understanding that money has been programmed for this area of research. And in addition to that, there is incremental funding of programs in the outyears. So that if there is promising research that has been identified and is ongoing, then that is often funded in the year of execution.

Dr. SNYDER. In your opening statement, you described that, Dr. Smith, as vigorous research funding. It doesn't seem incredibly robust to me. Am I wrong? I mean, it seems like this is a huge problem; it is a huge national and international problem. You have got major facilities around the world. It seems like that money would be stretched out pretty thinly, pretty rapidly. Is that a fair statement?

Dr. SMITH. I am not sure that I used the "vigorous funding," sir, when—in my statement.

Dr. SNYDER. I think you said "vigorous research."

Dr. SMITH. We certainly do have funding allocated for research. And this is very definitely an important, a vital area of interest for the military. But as you pointed out, it is also a national problem and we are collaborating with, coordinating with the National Institutes of Health and other organizations that are devoting research dollars to this. We do have to balance our research funding in this area with other areas of military research interest. So it is

in a competitive process. But as I say, we have $13.6 million for this year.

Dr. SNYDER. I think your opening statement on page six says the DOD has a vigorous research program. And around here when we hear "vigorous," we automatically think of funding, I guess.

Mr. Wittman, I went over my time. Mr. Wittman.

Mr. WITTMAN. Thank you, Mr. Chairman. I will begin with Dr. Smith, and I would like to get the perspective, too, of the other folks here from the different service branches. I want to focus on the element of training and the element of deployed infection control officers downrange.

First of all, I would like for you to give us an overview about the scope and breadth of training that our infection control officers receive and our infection control personnel receive and our medical care personnel receive. Both in a deployed situation and back stateside; and then also to determine how are those individuals deployed downrange? What mixture of personnel do we have there? Is there a specifically assigned officer in charge of infection control at these medical care facilities downrange? Who are those personnel? I understand in the past that there were nurses that were assigned as infection control officers. Is that still the case?

If you could tell us a little bit about the extent of training and then how those individuals are deployed in our medical care facilities.

Dr. SMITH. Yes, sir. Well, I will begin with the policy level and work down probably as far as the stateside facilities, and then pass it to my service colleagues to speak a little bit more about the deployed environment.

But, of course, infection control is an element of the training of all medical professionals now. So our physicians, our nurses, our corpsmen, our technicians, are all being trained in their basic professional training about infection control.

There also is Joint Commission accreditation of our inpatient facilities and we have ambulatory accreditation of our outpatient clinics which have initiatives focused on infection control. Infection control programs are a requirement for accreditation in those. And along with that goes appropriate training and orientation of staff in the facility-level infection control programs.

I do know that in the predeployment setting, DOD is also providing some additional training for personnel, but would urge that we keep in mind that the people who are deploying into the operational setting are the same people who have been providing the care back in the medical treatment facilities.

So certainly the professional, fundamental training, the infection control specific training that they are getting and utilizing every day in our military treatment facilities is useful as they deploy to that operational environment. And there has been pointed out in some of the testimony some of the challenges of practicing good infection control procedures and prevention in that austere environment. That is very definitely a critical factor.

But let me pass to my left and ask whether the services would like to comment on the deployed environment.

Colonel HOSPENTHAL. I would agree with everything Dr. Smith has just stated. Certainly as medical healthcare professionals, we

all receive nearly continuous training in infection control because it has become such a big issue throughout the world.

In the deployed setting, certainly all the medical personnel have been working in hospitals and do have the basic training. Our mission in 2008 to review infection control practices and challenges revealed that there really weren't well-trained, dedicated infection control officers in charge of the program at the Level III facilities. It wasn't that the personnel weren't doing infection control or weren't doing a pretty good job, but the infection control officers that we have seen downrange really had not had more training and additional training. And often they were nurses, and often they really didn't have dedicated time to do their infection control officer duties.

And that is really the challenge that we identified and focused on over the last several years: developing the kind of just-in-time five-day infection control officer course and in getting policy changed on the Army side to stress infection control.

Recently there was an EXORD [executive order], actually this week, that went through that makes it a requirement that as the CSH is—as the Combat Support Hospital breaks into separate pieces, rather than operate as one single unit, that each one of those pieces or slices as we call them that have inpatients have an infection control officer who has been trained in either our five-day just-in-time course, or who has experience.

And I believe this problem has really developed because of the operational tempo. We have a lot of hospitals downrange. We have been there a long time, and these hospitals are not operating as a single CSH. They are broken into multiple segments. And because of that, we just did not have enough infection control officers trained throughout this.

Captain MARTIN. I really have to defer to my two previous colleagues because I think most of what they said really refers to all of us. Since all of these in-theater hospitals are really Tri-Service, we talk constantly. I mean, I am on a constant first-name basis with all of these guys; and we know what is going on, who is going where, and we have a pretty good handle on the issues.

I think, as Colonel Hospenthal just brought up, earlier on in the war things were a little less organized as far as what we knew was going on. And now the focus on infection control is much more evident at all of these facilities, both in CONUS and OCONUS [outside the continental U.S.]. So I think that we are really—have a much better handle on ensuring that infection control practices—standard practices are being met, even at a much more forward setting than we had previously.

I also have with me Ms. Judy English, who is your Navy infection control leader consultant. And any comments about specific things that you would want to bring up from—she is an infection control nurse, and I think she is one of the only nurses we have in here. And it has been an important thing for Judy to be at BUMED because I think it emphasizes just how important infection control is to the Navy both in CONUS and OCONUS.

Ms. ENGLISH. Thank you. Thank you, sir.

The Navy infection prevention and control arena has been trying in CONUS to civilianize. So that at this point in time, 68 percent

of our infection preventionists are civilians. And I have a monthly video teleconference and digital conference online that is two times in the day, so people all over the world can sign on. And this is for management and education purposes. And we do this continuously, as well as the usual getting together.

We are also working with the Army and the Air Force as members of the TMA [TRICARE Management Activity] Infection Prevention and Control Panel. And we are now going over the data that Army, Navy, Air Force are all entering into the CDC's National Health Care Safety Network relevant to central line-associated bloodstream infections and ventilator-associated pneumonias in babies through the elderly in critical care.

And now the Navy is working with the Navy-Marine Corps and Public Health Center with beta testing sites to document all MDROs that are in CHCS [the Composite Health Care System], so that as soon as the Centers for Disease Control can accept HL7 [Health Level 7] download of these data, the entire Navy MTFs [medical treatment facilities] and DTFs [dental treatment facilities] will immediately go into downloading all of the MDROs, working with DOD and CDC. And this will be another benchmark data that is not as high as the pulsed-field gel electrophoresis that is going on. But this is the best that we can do without higher technology. This will be a 21st-century technology download as soon as CDC can accept these data.

Colonel COLLIER. Thank you. I think in the Air Force we mirror our sister services in our in-garrison performance, although, because of the small size of most of our facilities, it is a dual-hatted position. Downrange, we also dual-hat it, but those personnel have to have passed the training level required of an infection disease preventionist to get that position in our downrange hospitals.

The only additional place where we carry out additional training then is our air medical evacuation business. And the air medical evacuation crews do receive additional training in order to understand how that works on an otherwise dirty airplane.

So, yes, sir, thank you.

Dr. SNYDER. Thank you, Mr. Wittman.

Maybe I will start with you, Colonel Collier, and go the other way, or maybe you can speak for the whole group. But in terms of the development of new drugs—I mean, those are expensive research projects to try to come up with a new drug. How much are—is the military or military patients involved in research looking for the next generation or a new kind of drug to deal with these infections?

Colonel COLLIER. Sir, I am not able to answer that question, but I would ask my colleague if he has some input.

Colonel FORGIONE. Thank you. As far as the Air Force's position in that, we do participate in clinical trials through the Infectious Disease Clinical Research Program that is stood up at USUHS and is NIH-collaborative as well. And so we do occasionally have patients that will participate in large multicenter trials. As far as a direct research initiative in the Air Force looking for new drugs, we do not have that service at this time.

Captain MARTIN. This is kind of a difficult question because the DOD is not really set up well to develop new antimicrobial agents.

That is really probably such an expensive and difficult undertaking that "Big Pharma" is really the only ones with pockets deep enough and with the ability to develop a lot of new antimicrobial agents. Whereas the DOD, especially the Army, has developed all the antimalarials we have, and we have a pretty good system for looking at that.

It would really not be in our best interest for the DOD to start looking at the very basic science needed to do a lot of the regular antimicrobials. So what we have done, I think, is focus more on some of the things that we can work on. And that is the clinical side of it.

So we are doing some testing on some agents that are not approved in the United States now that have been funded, some Japanese products, and some other drugs that are really second- and third-line drugs we are using for some of these. We are looking at doing some studies with those clinically.

I think the more important thing is that we are able to collect a lot of these different isolates. We are allowed to. With our repository services and whatnot, able to molecularly characterize these. And then when other universities that have the ability to do this ask for isolates, we are able to send them out. We are able to send a lot of multidrug-resistant *Acinetobacter* isolates out because we have a large collection of them, because we have been able to hold them. And these are clinical isolates that they actually need.

So we partner with a lot of our civilian organizations. Dr. Smith talked about a lot of the funding. A lot of that funding actually goes out to civilian universities to do studies that we are really not equipped to be able to do. We are trying to focus more on the clinical end of things and directly with patients.

Colonel JAFFIN. Mr. Chairman, one of the things that we try and do in DOD medical research is we try and target those areas that the civilian sector is not targeting. There is an extensive, and has been mentioned, an extremely expensive program in Big Pharma to look for new antimicrobials. We have a few agents that we are looking at, some polypeptides and things like that.

But the main focus is to partner—to try to expand the indications for the new agents that a pharmaceutical company may be working with to try and target the specifically difficult organisms or organisms that are not seen commonly in civilian practice. And again, as Captain Martin mentioned, it is that partnership and the working with Big Pharma and other universities to enable to leverage our research dollars and our research interests with theirs.

Dr. SMITH. Yes, sir. And if I may comment, I agree with what has been said by my colleagues to my left. There are a few specific areas of research that DOD is pursuing that may have some particular military usefulness with human albumin and plastic coatings of orthopedic implants, predatory bacteria microbial biofilms for the treatment of burns and wound infections, and a look at *Staph aureus* [*Staphylococcus aureus*] toxoids.

So I think what we do have is a need for collaboration, coordination across many sectors, with DOD focusing on those areas of particular military interests, sir.

Dr. SNYDER. Do you think that the—you mentioned—I guess, you, Colonel Jaffin, mentioned Big Pharma dealing with this issue.

Are you convinced that there is adequate research going on in the private sector on resistant organisms? I mean, when you start looking at a specific Gram-negative bacteria that has resistance, the number of cases—it can be devastating to a person, devastating to a hospital to have to deal with it.

Are the economics there to make it worthwhile for a company to invest in that kind of research, not being sure you are going to find a solution?

Dr. SMITH. Sir, I am unable to comment on what Pharma may be investing in.

Dr. SNYDER. Well, we are talking about—you talked about you thought you had a specific niche, implying that the rest of it is over in the private sector. I am not convinced that there is adequate research going on in this area, looking for the next generation.

Colonel Hospenthal, do you have a comment?

Colonel HOSPENTHAL. I mean, from the non-DOD side, certainly the Infectious Disease Society of America which we are—the three consultants are members of—have identified this as a problem in getting new drugs, as has a similar counterpart in the EU [European Union]. There isn't that many drugs in the pipeline. I think——

Dr. SNYDER. If I can interrupt. That is actually what led to this hearing today, it was because, I don't know, sometime in the last couple of years I became convinced that this is an example where the military is inheriting a problem, whether it is lack of foreign language skills or whatever it is, and you are having to try to figure out how to solve it, but this is going to be a tough one to solve.

The reason there is not adequate dollars in the civilian side, is because it is going to take a huge amount of money to find a new drug, or two or three, for a relatively small number of cases, without much financial payoff. So then the question becomes, well, should we actually be beefing it up, should that perhaps be a role that we could play?

So I am interrupting you, but that is what led to this discussion. Because I don't see them in the pipeline either.

Colonel HOSPENTHAL. Well, because of the cost and because of the Big Pharma story, we have chosen to focus really the DOD research dollars on the wound, the colonization itself, the biofilms that are in the wound that allow these bacteria to, you know, survive and develop resistance.

So it isn't that we are not doing research on antimicrobials. We mostly have focused on topical antimicrobials in the wound, immune response in wounds, and how can we make that—and a wound has to have bacteria in it. We have bacteria all over our body. So how can we keep the numbers of the bacteria down and not produce superbugs in those wounds? That has been the focus that we have chosen with the research dollars over the last several years.

Captain MARTIN. You know, I just want to add to that, as you suggest, any microbial pipeline is really pretty empty. I mean, we don't have many new things coming down the line that look very promising for these really bad bugs. And as Colonel Hospenthal said, we are able to look at some other things, other than

antimicrobials to treat these. And I think vaccines have been a portion of it.

So we have a major problem with *Staph aureus* infections in the military, especially in recruit settings, just because they are common skin flora. And MRSA [Methicillin-resistant *Staphylococcus aureus*], widely known all over, is a big problem for us as well. So we are partnering with Pharma and looking at *Staph aureus* vaccines and doing those trials actually in troops in boot-camp type settings to see does this actually work in our setting. What we need in DOD, not what we need in end-stage renal disease patients in an ICU [incentive care unit] somewhere, but what we need in DOD.

So there are other vaccine-type candidates. We have to look at—something was mentioned a little bit about phage, where viruses that will attack bacteria have been looked at. All of these are important other avenues besides antimicrobials that we are trying to pursue. And, again, looking at the clinical end, where the science meets the patient; because that is what we are having to deal with as the clinicians involved in caring for these patients.

Ms. ENGLISH. And this whole lack of medication. People can't take a pill or have an IV [intravenous line] to kill the bug that they have, that we got so used to over the last few decades has brought us back to bedside care and scrupulous adherence to standard precautions. And if anybody shows any symptoms of something that might be contagious, we put a barrier between the healthcare provider and those moist body substances from the time they come back from overseas. And we use a long-acting chlorhexidine gluconate that stays on the skin for bathing these wounded warriors when they come back.

And we find out as soon as we can that they are colonized or infected, so that we go back to basics to keep them as healthy as possible and not to share their bugs among themselves. It is real hard to keep marine buddies away from each other when one of them is isolated and their buddy is in an ICU and is not isolated. But you know, in special circumstances, we have dressed up a marine dad so he could go in to see his baby born when he had *Acinetobacter*, when he had to do it on a video screen, and he and mom were able to know that they were there for each other.

Dr. SNYDER. Mr. Wittman.

Mr. WITTMAN. Thank you, Mr. Chairman. I think all these different pieces of the issue are very interesting in how they fit together and how we make sure that we are successful in the end.

One of the critical elements, I believe, is the system of surveillance; how do we look at reporting and tracking these multidrug-resistant organisms; how do we do that in our medical facilities?

And let me ask this. Can you all talk—and we will begin with Dr. Smith—talk a little bit about the current surveillance system? Is it adequate? What is it focused on? Has it developed through the years?

I know that the Army, I believe, has a system of tracking infections. I wanted to know a little bit about is that maybe a model that should be used across all of our medical facilities? And this is both downrange and deployed facilities and nondeployed facilities back here stateside.

So just a little bit about that in looking at the Army's multidrug-resistant organism repository and surveillance network to see if that is maybe a paradigm that could be used or what are the other services using as far as that effort to track and keep up with these organisms and the infections that go along with them?

Dr. Smith, I will begin with you and then I would like to get the other panel members.

Dr. SMITH. Yes, sir. Thank you.

I think we have—I would have to say we have a developing system of surveillance. It certainly has gotten better and better over time. And I mentioned a number of the elements of that network of surveillance.

We are utilizing our Armed Forces Health Surveillance Network. The Global Emerging Infections System is out there gathering information from our overseas labs. We are participating now in NSQIP, the National Surgical Quality Improvement Program, which has a focus on infectious complications of surgery. We are participating in the National Health Care Safety Network through the CDC, which gives us part of the picture. So we have a great deal of information that is beginning to be available to us. And the NHSN [National Healthcare Safety Network] and the NSQIP are relatively new for us. We are still looking at how we utilize those data.

The services, as you have heard, do have some other parts of that picture. But before I turn it over to them, let me say that they participate in our quality forum, which is run across service lines at the OSD [Office of the Secretary of Defense] level. So we do have our Infection Prevention Control Panel with the subject matter experts coming together to look at what can we see, what do we identify as problems, and what do we need to do about them in terms of both treatment, prevention, further surveillance, and also the research picture?

So let me turn it over then to service representatives to address their specifics.

Colonel HOSPENTHAL. Well, this is certainly a huge problem. And the biggest issue that I see that is difficult to actually fix here is that if we had a single thing to track and follow around this would be a whole lot easier. We could make it a reportable thing, call it brucellosis, and things would be much easier.

Even the CDC doesn't see this as something that is easy to put your arms around, because there are dozens of genus of these Gram-negative rods, there is probably 200 species of these Gram-negative rods, and there are literally probably thousands of different genetic elements that cause these resistance patterns.

So if you put all of those combinations together, they are hard to even decide what we are tracking and what we are looking to track with surveillance methodologies. And so even to pick out what we want to look for is difficult.

Certainly the Marine and Navy Public Health Center is working this through the CHCS data, but it is very difficult. CDC guidelines, because of this, really are to identify issues at your own facility and individualize your response and whether you conduct surveillance by doing cultures or by doing syndromic versus diagnostic results.

Certainly because of this and because of the fact that a lot of these don't even track by ICD–9 [International Classification of Diseases, 9th revision] codes, there is not an ICD–9 code for *Acinetobacter*, is one of the reasons that we actually put together the standardized screening at Landstuhl, National Naval, Walter Reed, and BAMC [Brooke Army Medical Center] is just so we could have an idea of how many of these *Acinetobacters* and how many of these other MDROs are coming through the door from the combat theater, from Landstuhl as they transfer into the U.S.

So with the MRSN [Multidrug-resistant Organism Repository and Surveillance Network], the hope would be that this will help provide some answers with some tracking data from the JTTS [Joint Theater Trauma System] and JTTR [Joint Theater Trauma Registry]. The MRSN is housed as an Army program currently, but it has always been thought of as being a DOD program over the long term. And certainly my Navy and Air Force colleagues were involved and still are involved in running that program. That program is based at the Walter Reed Army Institute of Research, but it certainly gets National Naval Medical Center isolates, Landstuhl isolates, et cetera.

Captain MARTIN. Just to add on to what Colonel Hospenthal said, I think that this is also an issue of trying to track these things where you don't know if a patient is colonized or infected. We get asked how many of these you have. Well, do you count the one that the same patient has had multiple times in the lab over a long period of time? It becomes really difficult to track.

We have been able to, and it was just alluded to through the Navy and Marine Corps Public Health Center looking at the CHCS computer system that is used DOD-wide, now able to really look at the—they are trying to get all the hospitals to report resistance the same way so they can look at this.

But this whole question about the recent superbug coming out of India, NDM–1, we are asked how much of this are we seeing in the Navy and Marine Corps? We are very quickly able to go through and say, we are not seeing any of this; we haven't seen any isolates of this. We could go through and look at all of the stuff in the repository and say, there is not any of this.

The study I talked about, TIDOS, the Trauma Infectious Diseases Outcomes Study, is really collecting all of these specimens from everybody, Army, Navy, Air Force. Even though it has a Navy-funded program, most of the work is actually done at Army hospitals. All of those isolates are collected, we are able to save them and see what is going on, and have a pretty good handle now, which we really didn't have five or six years ago on what is going on with MDROs.

Ms. ENGLISH. Infection control-wise, in the Navy and Army for patients who have MDROs or some other epidemiologically important pathogen, since the BRAC [Base Realignment and Closure] is coming soon, Walter Reed and National Naval Medical Center have become closer and closer, and we have devised identical protocols. And we put, for bed management, if a patient has ever had an MDRO, we have them listed. We note that in AHLTA and/or CHCS [the patient electronic health record] so the bed manager will note when they come back to the clinic or as an inpatient and puts them

on appropriate transmission-based precautions. And this is communicated among the different services, and as people are sent to San Antonio to go back closer to home. But inside the Beltway is where this started.

We also devised a clearance culture protocol using the Infectious Diseases and Infection Prevention people from Walter Reed and National Naval Medical Center in congruence with the Centers for Disease Control, because it is so hard to keep people on isolation precautions when they feel better, they are not dripping anymore. Do we have to stay here? Can't I go visit my buddy? And we devised a protocol so that there are three screenings, at least 72 hours apart, when the person has been off all antimicrobial therapy for the bug for at least 72 hours. And this was agreeable to all three places. And that was a first, to get people off isolation without having to wait weeks or months.

Colonel FORGIONE. I think, as all the folks up here have expressed, that this is really a process in evolution. And I think we have some very good basic surveillance going and some platforms that are going to help us to answer a lot of these questions.

With these MDROs, it is a little different than some of our tried-and-true reportable diseases, like tuberculosis, where we have a very long history of managing this, very good guidelines of how we do it, and it is all reported. I think we are still defining what an MDRO infection is in some places and what colonization versus true infection means.

And as the network that I think we have set up across the services continues to evolve, we will be able to provide better answers and then provide maybe guidelines out there that would then better define exactly what these entities are and how to address them.

Captain MARTIN. Sir, can I add one thing? Also not to toot our own horns, but I think in infectious disease, infection control communities in the DOD are probably one of the more united groups of anywhere in medicine in the DOD. We cross-train at Bethesda and Walter Reed. We are Army and Navy. In San Antonio we are Army and Air Force. We swap staff around frequently. We have a very good idea of what is going on.

And so when we talked about this before, it was hard for us to separate out what we would do in each service, because we really do this very much in a unified fashion, which I think is the best way for our patients and the best way overall for the way we want to go with this.

Dr. SNYDER. And for the sake of our transcriptionist, that "staff" was with a double F, and not with a P–H kind of thing.

I wanted to ask Ms. English, you talked very eloquently about really getting in the prevention aspects of it. Have you seen a difference over time, over the last several years, once an infection has been diagnosed in terms of how well patients have done as you have tracked that over the last six or seven years, once they are diagnosed with an infection?

Apparently not a dramatic improvement.

Captain MARTIN. I think that is a tough question and I think it is a very good question. I think that we are much more sensitive to the fact that we have to be ready to treat an MDRO right up front much more quickly. So we tend to collect our samples and

maybe more broadly treat with antimicrobial therapies up front than we would have before, which may give us a day or two jump on this before material comes back from the lab.

And we also have a pretty robust discussion among ourselves about how do you want to tackle this one. You know, this patient has renal failure, and on top of it has this MDRO and these other issues going on. Because these are tough, tough clinical cases to handle very frequently.

So I think we are a little faster to be able to get that together than maybe we were at first when we were a little more shocked by these. I don't know if you have any comments to add, Colonel Forgione, or——

Colonel HOSPENTHAL. I would agree with that. We have also made ourselves and our surgical colleagues aware that just looking for bacteria because it might be there is not always the best idea. So we do not swab wounds like we used to when we first started thinking about *Acinetobacter* and just treating the colonization. So we really have become more sophisticated into only treating folks who clearly have infections. That way we are not exposing our folks to some of these older and more toxic agents.

Overall, I think patients are doing better. But that is my anecdotal—my opinion. The TIDOS study certainly will give us that data on how folks were treated, what works best. The orthopedic groups in the military and across the civilian are doing some larger studies for prevention with irrigation pressures, irrigation fluids, irrigation additives for most of these.

Most of these are traumatic extremity injuries. So there is major funding for that research that is being done multicenter and internationally. And I certainly think that data will help us as well. We have developed prevention guidelines that talk about peri-injury antibiotics, debridement, irrigation, et cetera. That is a DOD, Army, Air Force, Navy program. We are actually in the middle of revising those guidelines and doing an update for prevention.

And I guess one side note, during all of this we noticed that minocycline was actually an effective old drug for at least the *Acinetobacters*. And we did work with the company that actually owned the license for intravenous minocycline to get it back on the market. It was never—it is still approved. It is now available again.

Dr. SNYDER. Colonel Hospenthal, I want to make sure I understand what you are saying about the irrigation. On the studies on the irrigation, are you saying that sometimes there is inadequate irrigation in terms of cleansing, or you can fire-hose it away to where you devitalize some tissue?

Colonel HOSPENTHAL. Right. Probably the latter is more important. I mean no one really knows how much irrigation fluid to use. But is that really important? If you need to use it, how much you need to get all the visible junk out of there.

More important is the pressure. There is a division among surgeons, and in the literature, both basic research and animal research and clinical trials, that high pressure is better because these explosive IED blasts push things up in there and we need to get them out so they don't become a nidus of infection, versus high pressure is really only used to chisel away at bones and take out bone marrow, and you shouldn't be using high pressure and caus-

ing more tissue damage that then might get infected. So trying to sort out which of those actually is the better approach is being funded as a clinical trial.

And then there is the debate, you know, naturally you are thinking if I am pushing fluid up in there, wouldn't it be better to have some antimicrobial or antiseptic compound in that fluid? Well, the research on that is all over the board as well. A lot of the things that we would put in fluid to irrigate actually kills bacteria, but it also kills growing and granulating tissue. And so it may cause delayed healing that then does get infected. So there are research projects into looking at additives for irrigation fluid as well.

Dr. SNYDER. I can't let you all get out of here today without at least having you respond to the following question. I had a discussion this morning with somebody who works on the Hill, expressing their disappointment about going to the doctor yesterday with about a day and a half of a cold, and the doctor just flat-out refused to give them antibiotics. And this person was incensed that that was the case, and probably was doctor shopping.

Any one of you want to comment on the issue of the proper use and overuse of antibiotics and its relationship to these challenges you all are talking about today?

Colonel JAFFIN. Sir, I think you have hit the—one of the big problems around the world is that the expectation that anything that you go to a doctor for needs antibiotics to cure. We have aggressively taught that to all our healthcare providers, all our healthcare team, that you only use antibiotics when clinically indicated, and you use the most specific antibiotic for that particular organism to prevent the growth of drug resistance.

Captain MARTIN. I think it is a very, very interesting question. And I have found kind of a dichotomy. That here in the U.S., because people now have heard about the overuse of antibiotics, in some people it has been easier to tell them you don't need an antibiotic for this.

I think, as the Colonel just mentioned, the problem is in a lot of the rest of the world—and I have lived and worked overseas before in Latin America, and we are seeing this now with the bugs coming out of India. A lot of the other world, the rest of the world, you can just go and buy antibiotics. And people frequently do, and take a day or two, or a dose or two of all kinds of antibiotics.

So we see some of the most resistant bugs coming out of the developing world, where you wouldn't expect that they would have ready access to some of these, but they do. So we see whether it is multidrug-resistant *Salmonella* infections out of Southeast Asia or sexually transmitted infections. Big problems with this. And a lot of it is inappropriate use of antibiotics. I think we have a lot of inappropriate use in the U.S. still, not nearly what we had before.

And the example you brought up is I think the most common one. I mean, busy physicians who have six and a half minutes to see a patient, sometimes it is easier to pull out the prescription pad and give them what they want than it is to talk them through the fact that they have a viral infection.

Ms. ENGLISH. Excuse me. But on the other hand, this weekend starts the 2010–11 flu season. And if your colleague had a fever

above 100.4 and upper respiratory symptoms, he would be wise to consult with his primary care provider to receive oseltamivir if he hasn't received his flu shot by now.

Mr. WITTMAN. Just one additional question. This is a little bit in the weeds. But I noticed, Ms. English, you made reference to pulsed field as one of the treatments. I know I was intrigued by some of the research that is going on out there with actually accelerating wound healing with that technology. And I know that in my previous life in working in public health, there was a lot of research there as far as food safety, and having it as an antimicrobial agent in food preparation.

But I would be interested to hear a little bit more from you about the future of that technology and the applicability there as far as infection control.

Captain MARTIN. I think there was a little confusion. What she was talking about was pulsed-field gel electrophoresis characterizing organisms, which is a different thing than what you are talking about, which is also being looked at.

And in fact in the new hospital, the new Bethesda that we are building, they are looking a lot at using some pulses of ultraviolet and whatnot to knock down contamination in operating rooms and in other rooms. So that is another moving area that is really important, especially when you are talking about organisms that are even becoming resistant to some of the topical antimicrobials that we use. So that is ongoing research as well.

Dr. SNYDER. Thank you all for your time today, and thank you for the work that you do. I will leave it as an open-ended question for the record. If any of you have anything additional you would like to add, please send it to the staff here in the next week or so, and we will get it to the Members and also include it as part of the record of this hearing.

I hope as time goes by, as you all continue your thinking about these issues, if you see a further congressional role in this, I hope you will let us know, because we would be very receptive to doing what we can. If it is a funding need or whatever it is, we would certainly be glad to look at it if you see some additional needs there that are not being met that Congress can play a role in.

Thank you all very much. The hearing is adjourned.

[Whereupon, at 2:51 p.m., the subcommittee was adjourned.]

A P P E N D I X

SEPTEMBER 29, 2010

PREPARED STATEMENTS SUBMITTED FOR THE RECORD

SEPTEMBER 29, 2010

Statement of Ranking Member Rob Wittman
Subcommittee on Oversight and Investigations
House Armed Services Committee

Hearing on DOD's Response to Multidrug Resistant Infections in Military Treatment Facilities

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September 29, 2010

Thank you, Chairman Snyder, and good afternoon to our witnesses.

It's easy to start a debate or find a contrary view on almost every issue that arises in Washington, DC. The subject of today's hearing is the rare exception to that rule.

No political party, no health care provider, and certainly no patient wants any part of infection, much less the virulent infections that are the subject of today's hearing. Multidrug Resistant organisms, or MDRO, are a serious matter for both military and civilian health care providers, and are with us to stay, I fear. I understand that infection control demands constant vigilance in medical facilities, requiring careful training and strict adherence to proper procedures within all areas of military treatment facilities.

Infection control is particularly difficult in an austere, deployed setting with limited supplies, limited access to fresh water, and the necessity of handling potentially large numbers of casualties who've been living in a

field environment. I traveled last spring to Afghanistan, and was covered in dust after a single day of moving about Kandahar Province. I can only imagine the condition of troops living in the field for months at a time. Infection control in such conditions must be daunting.

We are all glad to see that the growing problem of gram negative bacterial infections in military facilities was identified several years ago, and that considerable progress has been made in screening for and controlling these infections. In fact, the number of cases for the most virulent bacteria was cut by almost two thirds in military facilities from the peak.

Still, improvements can be made in enforcing infection control protocols; in reporting mechanisms; and in research for both better treatment and better control procedures. We on the committee fully support your efforts in this area and look forward to hearing how we can help you continue to make progress combating infections of all types.

I look forward to the testimony of our witnesses.

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LOUISE M. SLAUGHTER
CONGRESS OF THE UNITED STATES
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September 29, 2010
Statement for the Record
Oversight and Investigations Subcommittee
House Armed Services Committee

M. Chairman,

M. Chairman and Members of the Committee, thank you for taking the time to hold a hearing on this important subject, as well as for giving me the opportunity to submit testimony. To effectively respond to the rise of multi-drug resistant *Acinetobacter baumanii* infections in the military, we need to develop a coordinated, comprehensive strategy to fight *Acenitobacter* and other antibiotic resistant pathogens in the military and in the general population.

Alongside of combat injuries, our soldiers face the deadly threat of multi-drug resistant (MDR) infections after they are wounded. *Acinetobacter baumannii* and other MDR strains of gram-negative bacteria are increasingly impacting our soldiers. Between 2004 and 2009, at least 3,300 members of the military were treated for *Acinetobacter* infections according to Department of Defense (DOD). This gram-negative bacteria is particularly dangerous due to its tendency to occur in strains that are resistant to almost all available drugs. Frequently, the only line of defense is colistin, an antibiotic that was phased out in the 1970s due to its toxicity.

The military has worked aggressively to respond to the threat posed by *Acinetobacter* and other MDR pathogens. In 2009, the U.S. Army established a surveillance system called the Multi-resistant Organism Repository and Surveillance Network. In order to improve data collection, the DOD also has begun to participate in the Center for Disease Control and Prevention's (CDC) National Healthcare Safety Network reporting system. Furthermore, the DOD has expanded infection control and prevention practices in military hospitals. These efforts by the military, described in documents prepared by the House Armed Services Committee, have helped to limit the impact of MDR pathogens on wounded soldiers.

While I appreciate the current response by the Department of Defense, the U.S. military needs to take additional steps to prevent the spread of MDR like *A. baumannii*. Specifically, I recommend that the DOD:

- Require additional training at all military facilities on hygiene and other treatment and

control techniques to reduce the spread of antibiotic resistant infections. Peer-reviewed infection reduction techniques -- such as those pioneered by Peter Pronovost -- have been shown to produce a 66 percent reduction in infections 18 months after adoption.

- Expand a comprehensive surveillance system, such as the Multi-Resistant Organism Repository and Surveillance Network, to all branches of the military.

- Fully implement the CDC's National Healthcare Safety Network reporting system in military facilities.

- Establish a coordinated, comprehensive DOD research program on antibiotic resistant infections, including *A. baumanniii.* Any comprehensive MDR research program must address the causes of antibiotic resistance in all sectors, including agricultural usage and human usage.

While these actions will slow the spread of *Acinetobacter* and other MDR bacteria, the battle against multi-drug resistant pathogens cannot be won by the military alone.

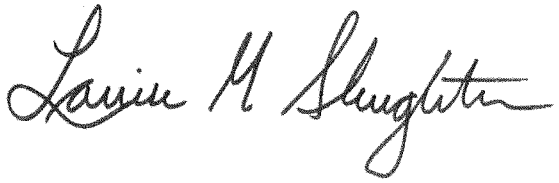
Defeating *Acinetobacter* and other antibiotic resistant pathogens requires help from the civilian public health infrastructure as well as the military. Indeed, antibiotic resistance is a rising epidemic in the United States and abroad. Every year, almost two million Americans acquire bacterial infections during their hospital stay, and 90,000 will die from them. 70 percent of hospital-acquired infections are resistant to at least one antibiotic. Antibiotic resistance is estimated to cost society over $35 billion nationally.

Federal agencies are united by their concern with the rise of antibiotic resistance, and have developed a series of comprehensive public health recommendations on MDR. Any attempt to respond to antibiotic resistant infections will need to be comprehensive and address all sectors of society – including hospitals, physicians, nurses, public health officials, and farmers. A holistic, comprehensive, and evidence-based strategy to strengthen the public health response to MDR bacteria would include the following steps:

- Establish and promote a high-level Interagency Working Group to enhance the national strategy to prevent antibiotic resistant infections;
- Increase monitoring and surveillance of *Acinetobacter baumannii* at the local, state, and national level;
- Encourage new initiatives established by the Patient Protection and Affordable Care Act (PPACA) to prioritize MDR pathogens, such as Section 3508's program to incorporate patient safety training into health professional education; and
- Support H.R. 1549, The Preservation of Antibiotics in Medical Treatment Act, which will phase out the non-therapeutic usage of antibiotics in livestock farming.

Together, evidence-based changes in human medicine, military services, public health surveillance, and agricultural practices can preserve the effectiveness of antibiotics.

M. Chairman, thank you for the opportunity to submit comments for the record, and I look forward to working with you and all the Members of this Committee, as well as other interested parties, to protect the integrity of our antibiotics and the health of American soldiers and families.



STATEMENT

BY

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OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
FOR HEALTH AFFAIRS

REGARDING

INFECTION CONTROL IN MILITARY FACILITIES

BEFORE THE

HOUSE COMMITTEE ON ARMED SERVICES

OVERSIGHT AND INVESTIGATIONS SUBCOMMITTEE

SEPTEMBER 29, 2010

Chairman Snyder, Ranking Member Wittman, Members of the Committee, thank you for the opportunity to discuss Department of Defense (DoD) efforts to address the growing challenge of healthcare-associated infections, particularly those from multi-drug resistant organisms (MDROs). We greatly appreciate the Committee's interest in this important issue, and its continued support of the dedicated men and women of America's Armed Forces.

Mr. Chairman, as the Committee so well understands, healthcare associated infections, including those from MDROs are not unique to the military but rather constitute a growing national problem in healthcare facilities across the nation. These pathogenic organisms, which are predominately bacteria, have not only increased the length of hospital stays, but are also responsible for increased mortality rates, so the problem is a serious one.

The source of the bacteria responsible for these infections is both environment and facility-related. In hospital settings, they can contaminate environmental surfaces, equipment such as ventilators and dialysis machines, air ventilation systems, water sources, the hands of health care workers, and the respiratory, urinary and gastrointestinal tracts and wounds of hospitalized patients. Other sources include soil, fresh water, vegetables and animals, as well as lice, fleas and ticks.

Accumulated data have shown that transmission infections from MDROs in combat-wounded Service members who have returned to the United States do not appear to have a single source or involve a single strain of bacteria suggestive of system issues, but rather are derived from multiple sources, which must be addressed as system issues.

Screening, Surveillance, Prevention and Control

The DoD has been actively engaged in measures to screen, surveil, prevent and control infection in military treatment facilities (MTFs) at home and on the battlefield.

The Military Health System (MHS) maintains a Quality Assurance Program, implemented in all MTFs, which establishes policies and procedures to minimize the risk of infection to patients and staff. The program includes infection control activities; patient care assessment, including a review of treatment procedures, therapeutics, blood and medication use; and reviews of healthcare records, health resources management, and risk management.

The Global Emerging Infection Surveillance and Response System, a division of the Armed Forces Health Surveillance Center, is a central hub that leverages the surveillance and response assets of the Services and overseas medical research units. Recent accomplishments include standardized laboratory characterization of *Acinetobacter*, a major MDRO, using uniform laboratory test systems and software at all

major receiving MTFs treating Service members with infected wounds, which will pave the way for laboratory standardization of other microbes of military interest.

The Multidrug Resistant Organisms Repository and Surveillance Network System, established by the Navy and Marine Corps EpiData Center (EDC), provides the ability to rapidly characterize emerging drug resistance threats, track and monitor MDRO patients, and reduce the risk of healthcare-associated infections. The network was established by the military infectious disease and microbiology community to study the problem of infection in deployed settings and in the continental United States, to detect localized sources, and to focus on infection control responses.

This capability, which is currently being tested at a pilot MTF, will aid the development of a daily alert surveillance system for MDROs of significant importance. The EDC already has the ability to rapidly analyze microbiology data and respond to inquiries regarding emerging antimicrobial resistance and pathogen surveillance in a timely manner, and has established metrics that provide visibility on trends both at specific MTFs and enterprise-wide.

The MHS has begun participation in the National Surgical Quality Improvement Program (NSQIP). Originally developed by the Department of Veterans Affairs (VA) and now offered by the American College of Surgeons (ACS), it currently includes 275 fully enrolled sites. The NSQIP is the only nationally recognized, validated, outcomes-

based, risk-adjusted, surgical quality improvement program. As of September 2010, 16 DoD MTFs had initiated their participation in ACS NSQIP. Initial risk-adjusted outcomes data from these facilities, including the occurrence of surgical site infections which could involve MDROs are expected to become available throughout calendar year 2011.

The Theater Joint Trauma Registry is also adding an infectious disease module to study and better understand the risks, interventions, and outcomes associated with combat trauma. Standard infection prevention and control practices, and standard clinical practice guidelines, have been established and implemented throughout the MHS in both garrison military treatment facilities and deployed areas. DoD partnerships have been established with the VA and the Department of Health and Human Services' Centers for Disease Control and Prevention (CDC) to address the challenges presented by MDRO and other infections.

With regard to screening, MDRO-specific policies are implemented at MTFs based on local risk assessment and identified needs. Admission MDRO colonization screening is performed at the four major receiving military medical centers for Operation Iraqi Freedom/Operation Enduring Freedom wounded: Landstuhl Regional Medical Center, Walter Reed Army Medical Center, National Naval Medical Center, and Brooke Army Medical Center. Patients are not released from contact precautions or isolation until they screen negative, and screening results are collected, reviewed, and reported.

The result is near real time monitoring of rates and epidemiology of MDRO colonization and infection in personnel evacuated from operational theaters.

In addition, MDRO prevention and control is a patient safety priority throughout the MHS. Standard hand washing and infection control precautions are used as a minimum in ambulatory care settings and, in acute care hospitals, contact precautions are implemented routinely for all known patients infected with MDROs.

The MHS has established an Infection Prevention and Control Panel (IPCP), which has infection control experts from each of the Services serving as a subcommittee to advise the MHS Quality Forum. In December 2008, the CDC's National Healthcare Safety Network (NHSN) was implemented within the MHS. The NHSN is a secure internet-based surveillance system. Currently, 33 MTFs are participating, and the IPCP has begun evaluating NHSN data. MTFs that are enrolled in NHSN voluntarily report healthcare associated infections. The NHSN collects data from healthcare facilities across the United States to note adherence to practices known to be associated with the prevention of healthcare associated infections (HAI). The data collected in NHSN is used to improve patient safety at the local and national levels.

MTFs began submitting data to NHSN in December 2009. After collecting a year's worth of data, MTFs will be able to compare device-associated infection rates such as Ventilator Associated Pneumonia with other healthcare facilities across the United

States. All infection preventionists receive initial training, and then again annually and as needed. Individual MTFs provide infection control orientation, annual updates, and targeted training to all staff.

Seventy MTFs and clinics have memberships in the Association for Professionals in Infection Control and Epidemiology (APIC) which provides additional training and an annual educational conference. In addition, an MHS online education activity entitled *Reducing Antimicrobial Resistance Through Judicious Use of Antimicrobial Agents and Patient Education* is available to MTF personnel. Physicians and nurses can receive continuing education credit for completing the course.

Military Research and Development

In addition to screening, surveillance, prevention and control, the DoD has a vigorous research program to further our understanding of MDRO and other infections, enhance the prevention and control of infections, and develop new treatments and therapeutics.

The Department assures a coordinated and sustained biomedical research and development program (to include MDROs) through the Armed Services Biomedical Research Evaluation and Management (ASBREM) Committee. The ASBREM Committee serves to facilitate coordination and prevent unnecessary duplication of effort

within DoD biomedical research and development and associated enabling research areas.

The ASBREM is chaired by the Director of Defense Research and Engineering, and co-chaired by the Assistant Secretary of Defense for Health Affairs. The committee includes Senior Executive representatives of relevant DoD Components' Acquisition Executives. The ASBREM reviews medical Research Development Test & Evaluation program plans and accomplishments for quality, relevance, and responsiveness to military operational needs, the needs of the MHS, and the goals of force health protection. They also review program plans and budgets in support of the various guidance documents relevant to national security and to the missions and functions of the DoD.

Several DoD research laboratories receive funding to conduct research on MDROs, including the Walter Reed Army Institute of Research (WRAIR), the U.S. Naval Research Laboratory, U.S. Navy Medical Research Center, the Institute of Surgical Research, Armed Forces Institute of Pathology, and the Walter Reed Army Medical Center. In general, the DoD strategy has been to look across industry and academia for solutions that appear most promising.

For example, in the area of wound infection, prevention, and management, recent studies have examined:

- A novel coating of human albumin plastic to inhibit bacteria colonization and biofilm formation on orthopaedic implants;

- The use of predatory bacteria to control drug-resistant bacteria and microbial biofilms associated with burn and wound infections; and

- Randomized multicenter trials to evaluate the safety and immunogenicity of *Staphylococcus Aureus toxiods* in healthy volunteers.

Each year, the DoD releases a solicitation of proposals focused on antimicrobial countermeasures and wound infection prevention and management. The Fiscal Year 2010 solicitation has been disseminated to DoD laboratories, academia, and industry. The proposals are evaluated through a scientific peer review process and a review for military program relevance. Lists of meritorious proposals are established, and the top proposals are slated for funding depending on the amount of funding available within each focus area.

In the area of wound infection prevention and management, proposals have been solicited to:

- Identify and characterize biomarkers that are associated with the immune response and/or predictive of infection/wound closure or early detection of antimicrobial resistance;

- Identify organisms that cause healthcare-related infections, and pursue mitigation of contamination in the military medical environment; and

- Develop an animal model of polytrauma/blast wound infection.

In the area of antimicrobial countermeasures, research efforts will be directed toward mitigation of factors that influence severity of infections and metabolic pathways associated with organisms that cause MDRO wound infection, including characterization and mitigation of biofilm formation. These wound infection organisms include: *Acinetobacter, Pseudomonas aeruginosa*, MRSA (methicillin-resistant *Staphylococcus aureus*), and ESBL (Extended spectrum beta lactamase)-producing enteric bacteria (*Eschericia coli, Klebsiella pneumonia*, and *Enterobacter* species).

The Department has a preference for discoveries with applicability to infections with multiple organisms, leading to products to treat wound infections that are approved by the Food and Drug Administration.

Additional treatment efforts are focused on topical approaches (application of medicine to the skin). DoD collaborative efforts have arisen with both industry partners and academia. For example, the Wound Infection Program at WRAIR has partnered with Meiji Seika Kaisha, Ltd. of Japan and Johns Hopkins University to support a new indication for the use of *arbekacin*, an antibiotic.

The DoD strategy is wide-ranging, and it will widen the clinical toolbox to prevent or mitigate MDRO wound infections that can be devastating to our wounded warriors.

Conclusion

Mr. Chairman, I hope this provides the Committee with some useful insight into how the DoD has responded to outbreaks of MDRO and other infections in military personnel, as well as the surveillance, control and prevention, and research and development programs in place to help us manage infections now and in the future.

Again, we appreciate the Committee's interest in this important issue, and I am happy to respond to any questions you may have.

# # #

RECORD VERSION

STATEMENT OF

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HOUSE ARMED SERVICES COMMITTEE

OVERSIGHT AND INVESTIGATIONS SUBCOMMITTEE

UNITED STATES HOUSE OF REPRESENTATIVES

2nd SESSION, 111TH CONGRESS

HEARING ON MULTI-DRUG RESISTANT ORGANISM INFECTIONS

29 SEPTEMBER 2010

NOT FOR PUBLICATION

UNTIL RELEASED BY THE

HOUSE ARMED SERVICES COMMITTEE

Chairman Snyder, Representative Wittman, members of the committee, thank you for the opportunity to discuss US Army efforts to prevent and treat Multidrug-resistant organism (MDRO) infections.

Multidrug-resistant organisms, and more specifically, multidrug-resistant (MDR) gram-negative bacteria, have increasingly become a healthcare threat in the US and worldwide. The Infectious Diseases Society of America has attempted to increase awareness of this issue in the US through their "Bad Bugs, No Drugs" campaign. Infections with these organisms chiefly occur in hospitalized patients, often through transmission between patients (i.e., through cross-contamination), and are termed healthcare or hospital-acquired infections (HAI), also known as nosocomial infections. This increase in MDRO infections has reduced the extent to which bacterial infections are treatable by antibiotic drugs. Focus in the US and abroad to control these infections has included attempts to prevent transmission of MDRO within hospitals and other healthcare settings. These infection prevention and control efforts have been championed by The Joint Commission (TJC) through patient safety goals and by the Centers for Disease Control (CDC) through guidelines for the prevention of MDRO infections.

Since the onset of Operations Iraqi Freedom and Enduring Freedom, infection and colonization with MDRO, especially MDR *Acinetobacter baumannii-calcoaceticus* complex, have complicated the care of injured US military personnel returning from Iraq and Afghanistan. Other MDRO causing infections in our wounded include extended-spectrum beta-lactamase producing enterobacteriaceae (e.g., *E. coli*, *Klebsiella*

pneumoniae), MDR *Pseudomonas aeruginosa*, and methicillin-resistant *Staphylococus aureus* (MRSA).

The source of these bacteria in our returning combat-injured personnel has not been fully elucidated. Although most of these bacteria can be found on the skin of healthy people, it is not common to find MDR strains of these bacteria colonizing in healthy adults. Studies in healthy Soldiers have not found MDR gram-negative bacteria, although MRSA is not uncommonly found (as with Americans in general). There have been some suggestions that these bacteria might be introduced into wounds at the time of injury from environmental debris. This has not been supported by several small studies looking for early MDRO contamination of wounds. It appears most likely these bacteria are spread nosocomially both in the combat theater, along the long journey back to, and within, military medical centers in the US.

DoD Regulation 6025.13-R requires military treatment facilities (MTFs) to have a Healthcare Quality Assurance Program. These programs mirror those in US civilian facilities and include activities such as infection control, patient care assessment, review of healthcare records, health resources management review, and risk management review. As is suggested by TJC and CDC guidelines, MDRO-specific responses/policies at individual MTFs are based on local risk assessment and identified needs. TJC National Patient Safety Goal 07.03.01 requires hospitals to implement evidence-based practices to prevent hospital-acquired infections due to MDRO. Patients with known or suspected MDRO are placed under contact precautions (i.e , healthcare providers wear gloves and gowns when providing care), based on CDC guidelines, to decrease nosocomial spread. In 2008, the Military Healthcare System

(MHS) joined the CDC's National Healthcare Safety Network (NHSN), allowing sharing and comparison of HAI data with other US healthcare facilities.

In addition to routine practice and participation in US civilian healthcare standards (TJC, CDC guidelines, etc.), the MHS has responded with specific efforts focused on ameliorating the MDRO problem in returning injured US military personnel. These include establishment of admission MDRO colonization screening of injured personnel, development of specific guidelines to prevent infections in the combat-injured, efforts to improve infection prevention and control in the combat theaters, establishment of a MDRO repository and surveillance network, and enhanced research efforts.

Admission MDRO colonization screening is performed at major medical centers (Landstuhl Regional Medical Center, Walter Reed Army Medical Center, National Naval Medical Center, Brooke Army Medical Center) who receive combat-injured US personnel. Established in 2005 to screen only for *Acinetobacter*, this program currently screens for all MDRO. Patients are not released from contact precautions/isolation unless they screen negative. Results from this screening are collated, reviewed, and reported by monthly rates. This provides near real-time monitoring of rates and epidemiology of MDRO colonization and infection in evacuated personnel. The DoD Global Emerging Infection Surveillance and Response System (GEIS; a division of the Armed Forces Health Surveillance Center (AFHSC)) has supported the clinical laboratories performing this admission screening through funding of molecular typing equipment to further enhance epidemiological study of the recovered MDRO.

Clinical practice guidelines developed by a US Army, Air Force, Navy, and civilian consensus conference have been produced and promoted These guidelines for the prevention of infection after combat-related injuries focus on limiting antibiotic overuse and basic infection control interventions. Critical review of infection control practices and challenges in the combat theater hospitals have been conducted in 2008 and 2009. From these review missions, interventions to improve infection control efforts in the deployed setting have been pursued. These have included renewed focus on basic infection control practices such as handwashing, isolation precautions, cohorting (grouping people with similar infections together), and deployment of clinical microbiology and antibiotic control. Additionally, electronic resources have been established to support deployed healthcare providers. The Army Medical Department Center and School hosts a short course to train additional infection control officers to lead infection control efforts in our deployed hospitals. A standardized infection control policy was produced and adopted by the Afghanistan theater. Medical personnel deploying with or to a Combat Support Hospital receive training on prevention and control of infections at the Joint Forces Combat Trauma Management Course at Fort Sam Houston. This course provides guidance to US military health care providers in the diagnosis, treatment, and prevention of infections in those individuals wounded in combat.

A repository to collect and study MDRO has been established with support of the United States Army Medical Research and Materiel Command. The MDRO Repository and Surveillance Network system (MRSN) was established to collect and characterize bacterial isolates and provide support for epidemiologic study of the MDRO problem

across the MHS, including in the combat theater. In conjunction with clinical and transportation data, the MRSN could help localize sources of MDRO to enhance and focus infection control responses. Data from the Joint Theater Trauma Registry (JTTR) will be essential to this effort.

Over the past several years the DoD has enhanced and expanded research in the prevention and treatment of MDRO. This includes the standing up of two new research programs – Intramural Wound Infection Research Program and Infectious Diseases Clinical Research Program. The DoD has established an intramural wound infection research section under the Military Infectious Diseases Research Program. This section has focused on better understanding the pathophysiology and treatment of MDRO infections. An interagency collaboration with the National Institute of Allergy and Immunology has established the Infectious Diseases Clinical Research Program (IDCRP). This program supports interservice multicenter clinical research focused on clinically important infectious disease threats to the warfighter and military community including MRSA and other MDROs, and infectious complications of war wounds. The IDCRP's Trauma Infectious Diseases Outcomes Study (TIDOS) began enrollment of patients in June 2009. TIDOS has been established to study interventions and outcomes in our combat-wounded who develop MDRO infections. The JTTR has established an infectious disease module which not only supplements this project, but provides data for further study of the infectious disease risks, interventions, and outcomes associated with combat trauma.

The US Army is committed to aggressive efforts to prevent and treat MDRO infections. This includes a commitment to continued research aimed at understanding,

preventing, and treating these infections. Additional efforts are underway to prevent the transmission of MDRO within our military hospitals. We join civilians, and other federal agencies, in our commitment to combat the spread of MDRO infections. Thank you again for the opportunity to address the Army's efforts and thank you for your continued support to our Nation's Soldiers.

Not for Publication until released by
the House Armed Services Committee

Statement of

Captain Gregory J. Martin, Medical Corps, United States Navy and
Ms. Judith English, RN, MSN, CIC (BUMED)

Before the

Subcommittee on Oversight and Investigations

of the

House Armed Services Committee

Subject:

Navy Medicine:
Surveillance, Prevention and Control, and Research
of
Multidrug Resistant Organisms

29 September 2010

Not for Publication until released by

the House Armed Services Committee

Chairman Snyder, Representative Wittman, distinguished Members of the Subcommittee, I am pleased to be with you today to update you on Navy Medicine's response to multidrug resistant organisms (MRDOs). As the Navy Medicine Specialty Leader for Infectious Diseases and a practicing infectious disease physician at the National Naval Medicine Center, Bethesda, I can assure you that this issue is vitally important to the Navy Surgeon General, Vice Admiral Adam Robinson, and it has considerable focus at the Bureau of Medicine and Surgery (BUMED) and throughout Navy Medicine.

As the 20th century closed, the global medical community became increasingly aware that infectious diseases were far from vanquished. Bacteria that had been evolving for billions of years had been able to adapt to the antibiotics developed in the last 80 years -- leaving us with the reality of MDROs. This complex, worldwide threat has reached such critical proportions that earlier this year the Institute of Medicine of the National Academy of the Sciences sponsored a workshop "*Antibiotic Resistance: Implications for Global Health and Novel Intervention Strategies*" whose findings were released this month in a 440 page summary of the situation and how to address it[1].

In 2010, treating infections in the setting of widespread bacterial resistance has challenged the Military Health System (MHS) as it has hospitals throughout the US and rest of the world. The difference for the Department of Defense (DoD) has been the concomitant care of thousands of young, injured service members coming from the wars in Iraq and Afghanistan.

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[1] *Antibiotic Resistance: Implications for Global Health and Novel Intervention Strategies: Workshop Summary* Eileen R. Choffnes, David A. Relman, and Alison Mack, Rapporteurs; Forum on Microbial Threats; Institute of Medicine. National Academies Press, Washington, DC 2010.

Increasingly, many of these critically injured patients are colonized or infected with MDROs, especially gram-negative bacteria, that demonstrate resistance not just to first line antibiotics, but to all the major antibiotic classes in our armamentarium. This situation limits treatment options with either second line drugs with greater toxicity or, in some cases, no drugs to which the organism demonstrates sensitivity. As a result, this has led to an extensive search for the source of these multiple drug resistant organisms and how to most effectively treat and control their spread among patients and staff in our hospitals.

An emerging problem with drug resistance organisms in the deployed setting, initially *Acinetobacter baumannii* complex, first became evident on the USNS COMFORT (T-AH 20) during its deployment to the Persian Gulf in 2003. Subsequently, all three Services observed an increase in combat injured patients returning with resistant bacteria and the Services have addressed these problems in a similar fashion. As the two wars have continued, the MDRO problem has evolved from primarily *Acinetobacter* to an expanded problem with gram-negative bacteria producing Extended Spectrum Beta Lactamases (ESBLs) including *Escherichia coli, Klebsiella pneumoniae, Enterobacter cloacae* and *Pseudomonas aeruginosa,* as well as the widely publicized gram positive organism, methicillin resistant *Staphylococcus aureus* (MRSA).

The U.S. Centers for Disease Control and Prevention (CDC) has responded to the problem of MDROs in US hospitals with updated guidelines. DoD military treatment facilities (MTFs) have been following CDC recommendations as well as requirements established by The Joint Commission (TJC) for monitoring and responding to healthcare associated infections (HAI). Additionally, DoD regulation 6025.13R requires MTFs to have a Healthcare Quality Assurance Program that includes a locally constituted Infection Control Committee (ICC). The ICCs of every MTFs have increased their vigilance for these MDRO infections. In addition, the

military medical centers treating combat injured have gone further in establishing screening for MDROs upon hospital admission to identify colonized/infected patients. In 2008, DoD joined the CDC's National Healthcare Safety Network (NHSN) and mandated the use of the NHSN for reporting device-associated infections in critical care areas and HAI. Infection control professionals from MTFs participate in DoD's Infection Prevention and Control Panel (IPCP) to address issues in infection prevention and control including HAI. The IPCP collaboration includes Tri-Service and Office of the Assistant Secretary of Defense for Health Affairs/TRICARE Management Activity (TMA) representatives with responsibility for providing oversight, direction and guidance for Infection Control in the Military Health System. The joint IPCP group meets monthly to discuss infection prevention across the military by Navy, Army and Air Force infection prevention subject matter experts (SMEs). The SMEs and TMA track and report on NHSN data that includes the combat injured as part of the data for individual hospitals.

While most U.S. hospitals have reported these problems among long-term patients, frequently elderly in the Intensive Care Unit (ICU), MTFs experienced a different demographic, with most cases of MDRO infections occurring in younger, combat-injured patients. MDROs began to complicate chronic skin and soft tissue infections, osteomyelitis cases and, in some of the injured, led to increased limb loss, sepsis and death. The infectious diseases (ID) and infection control (IC) communities of the treating MTFs recognized the need for focused efforts in addressing a number of aspects of the MDRO problem in the combat injured. These included:

1. Determining the etiology of colonization/infection: Is the source at time of initial injury, early medical care in theater or from ICUs in the continental US? Are MDROs found in the environment, and how are these organisms related genetically? Bacterial isolates from patients should be maintained in a repository so they can be studied to determine how resistance has spread and to ascertain whether there is a relationship among different isolates.
2. Re-emphasizing standard infection control procedures at each level of care to minimize contamination of injured patients and transmission of MDROs to other patients in the MTF.
3. Making recommendations for antibiotic management to minimize selection of resistant organisms and to best manage established MDRO infections.
4. Investigating outcomes in the combat injury-related infections to determine what medications, techniques, etc., were associated with improved (or worse) outcomes.

These efforts involved coordination among the Services as well as among their respective surveillance, research and clinical activities. Additional information on these efforts includes:

Source of MDRO Infection/Colonization in the Combat Injured: The initial source of the bacterial contamination of these patients continues to be studied and is likely multi-factorial. It is increasingly recognized that even healthy people may be colonized with MDROs that uncommonly become a problem for a healthy individual. The clearest demonstration of this is MRSA that, like methicillin sensitive *Staph aureus*, may colonize the nose and skin of healthy adults. In the vast majority it causes no illness, but even an inconspicuous skin break may subsequently become infected. The extensive injuries

experienced by the combat wounded are therefore readily infected by bacteria that may be colonizing a previously healthy warfighter. Conversely, MDRO gram negative bacteria are generally not found colonizing normal adults (who do not work in a health care setting) and the source of these infections has been attributed to either the initial injury (i.e. a contaminated environment at time of injury as many of these organisms are soil and water contaminants, albeit usually not as MDROs) or more likely, as being transmitted nosocomially in the health care setting. Nosocomial infection may occur from initial contact in the field, at hospitals in theater, during transit, or while being cared for at intermediate stops at Landstuhl or at Level V care in CONUS facilities (tertiary medical facilities). As Colonel Duane Hospenthal, Medical Corps, United States Army and DoD colleagues published this year in the Journal of Trauma, it does appear that cross contamination from host nation nationals, who often are kept at facilities in theater for weeks to months, may have occurred[2]. These findings prompted a change in practice where these patients were cohorted separately from coalition patients who would be rapidly moving on to other DoD facilities.

Reemphasizing standard infection control procedures at each level of care: As combat injured patients move from theater-based treatment facilities to our medical centers , recognition that early identification of MDRO colonized or infected patients is critical in successful infection control of these bacteria. Establishment of MDRO colonization screening on admission to the major MTFs receiving the war injured (Landstuhl Regional Medical Center, Walter Reed Army Medical Center, National Naval

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[2] *Response to Infection Control Challenges in the Deployed Setting: Operations Iraqi and Enduring Freedom.* DR Hospenthal, HK Crouch, JF English et al. *Journal of TRAUMA Injury, Infection and Critical Care* 2010,69(1):S94-S101

Medical Center Bethesda, Brooke Army Medical Center) was first established at NNMC Bethesda in 2003. Initially this was designed to screen only for *Acinetobacter*, but as additional resistant bacteria were identified this program was expanded to include all MDROs at all four of the major MTFs caring for the combat injured. Patients are not released from contact precautions/isolation until their cultures are negative. Results from this screening are collated, reviewed, and reported by monthly rates that may be discussed by the IPCP. This provides near real-time monitoring of rates and epidemiology of MDRO colonization and infection and rapid identification of problems from a specific treatment facility. The DoD Global Emerging Infection Surveillance and Response System (GEIS; a division of the Armed Forces Health Surveillance Center (AFHSC)) has supported the clinical laboratories performing this admission screening through funding of molecular-typing equipment to further enhance epidemiological study of the recovered MDRO. Further characterization of the bacteria responsible for these infections can now also be performed through the repository capacity of the Trauma Infectious Disease Outcome Study (TIDOS) and the MDRO Repository and Surveillance Network (MRSN) system of the Walter Reed Army Institute of Research (WRAIR). These two projects, both inaugurated in the last year, will complement each other and allow for resistance phenotypes and molecular analysis of infecting and colonizing strains to determine relationships and common sources of these infections (as well as non MDRO and fungal organisms).

The Army, Navy and the Air Force have re-emphasized the need for basic infection control efforts in deployed settings whether on ships, in facilities in theater or in CONUS through clinical practice guidelines based on those of the CDC that have been

adapted for use in the deployed setting. The Army has spearheaded efforts that have subsequently been utilized by the Navy and Air Force. Specific efforts undertaken include:

a. Assessing prevention and infection control practices in theater by conducting on-site reviews of infection control practices by infectious diseases (ID) and infection control (IC) leadership.
b. Providing prevention and infection control training for individuals prior to deployment and ensuring identified infection control expertise is available at facilities in theater.
c. Establishing an internet based system for inquiries regarding ID/IC that have been established for providers in theater to have ready access to these professionals in CONUS.

Antibiotic Management: Recommendations for appropriate antibiotic stewardship are critical in both the treatment of those infected with MDROs but also in diminishing the selection of these organisms. Emphasizing the need to avoid overuse of the most broad spectrum antibiotics in an empiric setting has been addressed through education of the providers in theater and in the provision of improved laboratory capacity for obtaining cultures and sensitivities in theater. This has limited the need for use of multiple broad spectrum agents in critically ill patients in whom resistance organisms are likely to be selected. Frequent clinical conferences among ID staff at the major tertiary care MTFs in CONUS (WRAMC, NNMC Bethesda and BAMC) regarding treatment of the most highly resistant MDROs has been helpful in treating these patients and has led

to research protocols assessing the use of drugs such as colistin and arbekacin to treat the most highly resistant infections.

Clinical Outcomes: The interest that infections with MDROs have generated is related to the poor outcomes associated with these organisms. Persistent infections, prolonged hospitalizations, more numerous and extensive surgical procedures and loss of limb and life have been attributable to MDROs. The goal of those caring for the combat injured is to restore them to health as quickly as possible with as few complications as possible but addressing care for combat related infections has been lacking. Published or unpublished collections of anecdotal reports (from US and foreign, civilian and military hospitals) have led to challenges in how combat trauma should best be addressed.

Clearly, assessing what aspects of a patient's care have been associated with a better or worse outcome are critical in establishing better practices for everything from management of the initial injury, up to procedures performed at a tertiary referral center. This has prompted DoD clinicians to develop a program that will yield evidence-based strategies for the best care for combat-associated infections including MDROs. The Trauma Infectious Disease Outcomes Study (TIDOS) has been carefully designed to combine surveillance, laboratory and clinical data of combat injured patients identified in the DoD MTFs and follows them through their transition to the VA system. The capacity for DoD ID clinicians to work together in developing this needed project was made possible through the Uniformed Services University's (USU) Infectious Diseases Clinical Research Program (IDCRP). The IDCRP was developed and funded through an Inter Agency Agreement between USU and the National Institute of Allergy and Infectious Disease (NIAID) to perform clinical studies of infectious diseases of military importance, requires additional support for large projects.

The TIDOS effort has been funded primarily by BUMED and integrates the US Army Institute for Surgical Research's Joint Theater Trauma Registry (JTTR) through a specially designed Infectious Disease module. The TIDOS project began enrollment in June 2009 and addresses questions related to infection-specific incidence estimates, risk factor analyses, trends over time, and factors associated with treatment failure and success. During the June-August 2009 period, there were 356 Level IV trauma admissions at Landstuhl RMC with 192 (53.9%) of these patients transferred to WRAMC, BAMC or NNMC Bethesda. A relatively high proportion of the TIDOS cohort (40%) have left active duty service and registered for care in the Veterans Administration Medical Center system within one year of their injury. Infectious complications have been relatively common, 60% of patients experienced at least one infection and 22% developed an additional infection post-hospitalization. The overall incidence rate for infections (through hospitalization) was 2.0 per 100 person-days. Of the patients with infections, 50% had 2 or more separate infections and 10% experienced $\geq$ 4 separate infections. The most common infections were wound infections (34.6%), bloodstream infections (17.3%), and osteomyelitis (bone infection) (16.5%).

The TIDOS project is the first prospective evaluation of infectious disease complications/outcomes, among wounded military personnel, using predefined standardized methodology combined with analysis of clinical management, surgical and medical care (i.e. antimicrobial therapy), and clinical microbiology results across levels of care, medical facilities, and outpatient follow-up. At present, enrollment is over 500 combat-injured personnel and recent approval from the Veterans Administration was obtained to expand TIDOS follow-up to include patients as they transition to the VA. This first of its kind study for the DoD and VA is unique in providing for collection of data from combat-injured patients for five years (or

potentially longer). A gratifying aspect of the TIDOS study is the enrolled patients' recognition that what can be learned from their misfortune may lead to changes in practice and improvements in the care of future warriors who are injured in combat.

In summary, the response of the DoD Infectious Diseases and Infection Control communities to the threat of MDROs in our MTFs, especially among the combat injured, has been an effort coordinated among the Services while maintaining the requirement for site and service-specific guidelines at different MTFs. The coordination of surveillance, treatment and research efforts regarding infections in the combat injured has taken years to develop and is only in the last year coming to fruition. Given the continuing operational tempo of our overseas contingency operations, we can expect that injuries and infections with MDROs will continue in our facilities at all levels, however, our level of preparation to identify and treat these infections is at a much higher level than it was in 2002. Furthermore, military medicine is unique in its ability to collect the data and follow our patients and their infections in a manner that will permit a greater understanding of the epidemiology, prevention, control and treatment of MDRO infections. Our efforts will continue to be critical in supporting our world-wide force health protection mission.

Again, I appreciate the opportunity to update you on our efforts in support of protecting our Sailors and Marines against MDROs. We are making progress; however, we recognize there is much more to do. Please be assured that Navy Medicine, in conjunction with DoD and the Army and Air Force, is confronting this challenging issue directly and will continue to devote the expertise and resources to protect the health of our service members. That is our greatest responsibility. I look forward to your questions.

United States Air Force

Presentation

Before the House Armed Services Committee
Subcommittee on Oversight and Investigations

Multi-drug Resistant Infections

Witness Statement of Colonel (Dr.) James Collier
and Lieutenant Colonel (Dr.) Michael
Forgione

September 29, 2010

Chairman Snyder, Representative Wittman, and distinguished members of the Committee, thank you for the opportunity to discuss this critical issue with you today. The Air Force is working hard with our sister Services to control infectious disease in-theater and in our medical treatment facilities. This problem continues to challenge the medical community in both the public and private sectors around the globe, and we appreciate your support in our endeavors to address it.

Background

Throughout history, the development of resistance in bacteria, viruses and parasites to therapeutics and prevention strategies has been commonplace. Shortly after discovery and usage of a new therapeutic agent or prevention modality, most pathogens will develop one or more mechanisms to counteract these treatments or control measures. The use of antimicrobial treatment and control strategies, no matter how judicious or well controlled, inevitably leads to the selection and growth of resistant pathogens. Over the last several decades, we have seen many epidemics of resistant bacteria, viruses and parasites affecting the global health community with an increasing scope and scale.

The epidemic of concern for the discussion today is multidrug-resistant organisms (MDROs), and more specifically multidrug resistant (MDR) gram-negative bacteria. MDROs are microorganisms, particularly bacteria, that develop resistance to one or more therapeutic classes of antimicrobial agents. While there are many bacteria which can meet this definition, only certain MDROs have complicated the care of injured U.S military personnel returning from Iraq and Afghanistan. The MDROs seen since

the onset of Operations IRAQI FREEDOM (OIF) and ENDURING FREEDOM (OEF) causing colonization and or infection include *Acinetobacter baumannii-calcoaceticus* complex, extended-spectrum beta-lactamase (ESBL) producing enterobacteriaceae (e.g., *E. coli*, *Klebsiella pneumoniae*), MDR *Pseudomonas aeruginosa*, and methicillin-resistant *Staphylococus aureus* (MRSA). These bacteria typically colonize and lead to infections in hospitalized patients through transmissions between patients through nosocomial (i.e., healthcare/hospital-acquired) spread. This cross- contamination occurs because these bacteria can remain viable on environmental surfaces; equipment, including mechanical ventilators and dialysis machines; air ventilation systems and water sources; hands and clothes of healthcare workers; and the respiratory, urinary, gastrointestinal tracts and wounds of hospitalized patients. These pathogens are frequently resistant to most available antimicrobial agents.

This epidemic of increasing infections with MDRO is not limited to the Department of Defense. The increase in MDRO infections has resulted in a shortage of safe and effective antibiotics. This is a far-reaching U.S. and global health problem. In 1999, the Interagency Task Force on Antimicrobial Resistance was formed to address the problem of MDROs and antimicrobial resistance with the Centers for Disease Control (CDC), the Food and Drug Administration (FDA), and the National Institutes of Health (NIH) as co-chairs, and 7 other agencies including the DoD and the Department of Veterans Affairs (VA).

Despite the significant amount of effort put forth by many countries and organizations, the problem has continued to worsen, prompting the Institute of Medicine (IOM) of the National Academy of the Sciences' Board of Global Health to sponsor a

workshop "*Antibiotic Resistance: Implications for Global Health and Novel Intervention Strategies*. On Sept. 7, 2010, the IOM released a 440-page report discussing the nature and sources of antimicrobial resistance, implications for global health, and strategies to mitigate the current and future impacts of antimicrobial resistance.

While both civilian and DoD hospitals are dealing with this challenging epidemic, the demographic of patients with MDRO infections are different. Most U.S. hospitals have reported these problems among patients with an increased length of stay, frequently the elderly, with multiple complicated medical problems and usually in an intensive care unit. Military hospitals experience cases of MDRO infections occurring in the younger, combat-injured patients. MDROs complicate chronic skin and soft tissue infections, osteomyelitis and, in some of the injured, led to increased limb loss, sepsis and death.

Although bacteria colonize our skin, it is not common to find MDRO strains of these bacteria colonizing healthy adults with the exception of MRSA. In recent studies looking at the bacterial colonization on healthy soldiers, no MDR gram-negative bacteria have been found. Several small studies have also refuted that environmental contamination of war wounds at the time of injury in Iraq and Afghanistan is the source of MDROs. In civilian hospitals, MDROs are spread through nosocomial transmission. The etiology of MDROs in our returning combat-injured personnel has not been fully elucidated, however current data indicate that cross-contamination from host-nation patients likely plays a large role in our deployed military hospitals. It appears most likely these bacteria are spread nosocomially both in theater, and in our level III to level V medical centers.

In response to this challenge of treating and managing MDRO infections in our returning service members, the DOD has instituted coordinated Tri-service efforts in the areas of infection control and prevention, surveillance, and in research and development. I will briefly review some of the Air Force roles in these important collaborations.

Infection Control and Prevention

According to DoD regulation (6025.13R), all military treatment facilities (MTFs) have a Healthcare Quality Assurance Program. This program is responsible for activities such as infection control, staff credentialing function, patient care environment, patient care assessment, review of healthcare records, health resources management review, and risk management review. Military MTFs are held to the same standards as civilian institutions, and are accredited through The Joint Commission (TJC). Current TJC and CDC guidelines suggest that MDRO-specific responses/policies at individual MTFs are based on local risk assessment and identified needs. Personnel involved in the oversight and management of these facility-based programs receive standardized training in infection control practices and standards. Additionally, Fort Sam Houston in San Antonio, Texas, offers an "Infection Control in the Deployed Setting" course four times a year for those assigned to infection control duties during an upcoming deployment.

Clinical practice guidelines developed by a U.S. Army, Air Force, Navy, and civilian consensus conference on the prevention of infection after combat-related

injuries have been produced and promoted for use for MTFs. These guidelines provide a military perspective on infection control standards and practices for both forward deployed and CONUS facilities. Following the development of these clinical practice guidelines, a joint inspection team has conducted several in-theater assessments of infection control practices. Findings from these inspections helped to promote a renewed focus on basic infection control preventions and practices and the development of a standardized infection control policy for MTFs in the Afghanistan theater. Also, reports from these inspections have suggested that forward theater-wide infectious diseases and infection control oversight and management would improve patient care and outcomes. The Air Force has a specific package, the Expeditionary FFHA2 Infectious Disease team, which is available to provide dedicated infectious disease and infection control assets for the theater surgeon.

In 2008, the DoD joined the CDC's National Healthcare Safety Network (NHSN) and began exploring system-wide use of NHSN for reporting device-associated infections and hospital-associated infections (HAI). Appointed infection control professionals participate in the Infection Prevention and Control Panel (IPCP) that serves as the oversight board for DoD issues pertaining to infection prevention and control, including healthcare acquired infections. The IPCP is a collaborative committee comprised of Service and DoD Health Affairs (HA)/TRICARE Management Activity (TMA) representatives with responsibility for providing oversight, direction and guidance for Infection Control in the Military Health System. The joint IPCP group meets monthly to discuss infection prevention across the military by Navy, Army and Air Force infection

prevention subject matter experts (SMEs). The SMEs and TMA track and report on NHSN data.

The Air Force is committed to infection control throughout our continuum of care. The most common patients in our Air Force Theater Hospitals (AFTH) to develop MDRO infections are those who remain in intensive care units (ICU) for extended periods of time. Active duty ICU patients are stabilized and sent to Landstuhl Regional Medical Center (LRMC) or CONUS hospitals as quickly as possible. In contrast, injured Iraqi patients have very limited resources for long-term medical care within their country; thus tend to stay longer in the Theater Hospitals. This population is the one most susceptible to MDRO infections. The AFTH commander appoints a physician and nurse as the Infection Control officer and representative to provide ongoing oversight and promote continuing awareness of infection control standards. They conduct surveillance, provide educational briefings on antibiotic resistance issues/wound management and emphasize basic infection control (IC) efforts to prevent spread between hospitalized patients throughout the deployment rotation.

As the primary source of patient transportation from theater hospitals to LRMC and throughout CONUS, Aeromedical Evacuation (AE) is the linchpin of our health care continuum. Our AE crews are trained annually in infection control. In addition to the usual standard precautions, crews are trained to mitigate risk of transmitting nosocomial infections in the operational environment. They are trained to disinfect equipment (litters, litter pads, IV pumps, etc). They learn about airflow in the different airframes and where to position patients to avoid spreading of infection. In-flight kits contain spill

kits and Personal Protective Equipment (PPE) to include hand sanitizer that is placed throughout the cabin.

The Air Force has formal infection control courses that are conducted at Sheppard AFB, Texas. There are three levels of training provided: for those assigned to infection control positions (officer and enlisted) on the active duty side, for Reservists, and for those assigned as the Infection Control Function/Committee Chairperson. There are civilian infection control courses available that are equivalent in infection control program management. Two organizations that provide courses are the Association for Practitioners in Infection Control and Epidemiology (APIC) and the Society for Healthcare Epidemiology of America (SHEA).

The new, draft Air Force Instruction I44-108, "Infection Prevention and Control Program," has added an optional element suggesting an Infection Control Assistant active duty officer be rotated through the infection control office for those facilities that have a civilian infection preventionist assigned. This is designed to facilitate actual hands-on management of the IC Program in garrison for the active duty officer so he or she has some experience prior to deploying.

Surveillance

While none of the Air Force MTFs consistently receive combat-injured U.S. personnel at this time, our medics practice in all of the main MTFs responsible for the care of these patients, to include the forward hospitals and the Air Evacuation system. It is incumbent upon Air Force medics to understand the programs and principles of

managing MDRO patients in the Military Health System Currently, an admission MDRO colonization screening process of OIF/OEF wounded is in place at the San Antonio Military Medical Center (SAMMC), Landstuhl Regional Medical Center (LRMC) in Germany, the National Naval Medical Center (NNMC), and Walter Reed Army Medical Center (WRAMC). This screening program initially was started to identify and track patients with *Acinetobacter spp.* colonization and infections in 2005, and since 2008 has been standardized to track and analyze the MDRO problem. A recent review of this data has shown a significant decrease in the number and percentage of patients colonized with *Acinteobacter spp.* on arrival to LRMC and the three level V CONUS facilities.

The military infectious disease and microbiology community have recently established a MDRO Repository and Surveillance Network (MRSN) to collect bacterial isolates and provide support for epidemiologic study of the MDRO problem both in the deployed and CONUS setting. This repository, in conjunction with clinical and transportation data, will allow detection of localized sources of MDROs to enhance and focus infection control responses. The four major receiving medical centers (LRMC, NNMC, WRAMC, and SAMMC) have established standardized molecular epidemiologic testing (using pulse field gel electrophoresis) along with the Walter Reed Army Institute of Research (WRAIR), with the support of the DoD Global Emerging Infection Surveillance and Response System (GEIS), a division of the Armed Forces Health Surveillance Center (AFHSC). This standardization will allow comparison of bacterial isolates to enhance epidemiology and infection control efforts.

Research

As this epidemic has unfolded in our service members and MTFs, DoD has expended research in the prevention and treatment of MDROs through two main programs. The first program is an intramural wound infection research section in the Military Infectious Diseases Research Program (MIDRP). This program seeks to better define the pathophysiology of MDRO infections including biofilms, diagnostic testing and evaluation of wound microbiology, and treatment and prevention modalities. This is closely tied to an extramural program to promote DoD/civilian collaboration

The second program resides within the Uniformed Services University of Health Sciences (USUHS) Infectious Diseases Clinic Research Program (IDCRP) and capitalizes on resources centered at USUHS and the National Institute for Allergies and Infectious Diseases (NIAID) as well as the distributed network of DoD MTFs. Research in the IDCRP is focused toward clinically important infectious disease threats to the warfighter and military community including MRSA and other MDROs, and infectious complications of war wounds. The research is primarily performed through interservice MTFs, and many projects have collaboration with civilian research organizations and companies. In 2009, the Trauma Infectious Diseases Outcomes Study (TIDOS) was launched, a DoD/VA joint effort under the IDCRP to study interventions and outcomes in our combat wounded who develop MDROs.

Conclusion

While much remains to be done and understood to eliminate this complex medical dilemma, we continue to strive with the world's foremost infectious disease experts to find the answers that will prevent future patients from contracting disease from others in the very environment designed to protect and heal them. Whether they are our military and family members at home, or our Wounded Warriors in theater, we must find a solution to this constantly evolving challenge. We appreciate your support, Mr. Chairman, and that of the Committee, as we seek to achieve this daunting but critical goal.

QUESTIONS SUBMITTED BY MEMBERS POST HEARING

SEPTEMBER 29, 2010

QUESTIONS SUBMITTED BY DR. SNYDER

Dr. SNYDER. What does the Department of Defense need in order to have sufficient surveillance capabilities to identify and monitor multidrug-resistant infections throughout the military healthcare system? Should the Army's Multidrug-resistant Organism Repository and Surveillance Network (MRSN) be expanded to become a department-wide capability? If so, what policy and resources are needed to make this happen?

Dr. SMITH. The Department of Defense currently has sufficient surveillance capabilities to identify and monitor multidrug-resistant infections throughout the military healthcare system. We do not believe it's necessary to expand Army's Multidrug-resistant Organism Repository and Surveillance Network to become a department-wide capability. When necessary, we will consult Congress on the need for additional resources and authority.

Dr. SNYDER. Shouldn't MDROs be made reportable medical events in DOD and service surveillance systems such as the Global Emerging Infections Surveillance and Response System (GEIS)? Why aren't they?

Dr. SMITH. Although including selected Multidrug-Resistant Organisms as reportable events could have helped quantify the size of the issue, TRICARE Management Activity's Infection Prevention and Control Panel, which includes Service representatives and infectious disease experts, felt that in most circumstances tracking the infections was unlikely to affect the treatment and outcome for individual patients because patterns are monitored and acted upon by infectious disease and infection control practitioners among others at the local level. The panel also felt that electronic systems would soon be available (e.g., Multidrug-resistant Organism Repository and Surveillance Network System) that can be mined to help answer questions related to the size of the issue. The Department of Defense (DOD) determines which medical events are included in the DOD Tri-Service Reportable Events Guidelines only after reviewing recommendations from the Centers for Disease Control and Prevention, the Council of State and Territorial Epidemiologists, other public health organizations, International Health Regulations from the World Health Organization, and after soliciting advice from Infectious Disease experts throughout the Department.

Dr. SNYDER. What resources and policy are needed to provide military treatment facilities, particularly those in deployed areas, adequate standardized laboratory testing capabilities to identify and characterize MDROs?

Dr. SMITH. At this time, the Department of Defense does not need additional resources and policies to standardize laboratory testing capabilities to identify and characterize Multidrug-Resistant Organisms (MDROs). We will consult and work with Congress if resources and policy changes are necessary.

Dr. SNYDER. Over the past several years military research and development related to MDROs has been funded through several different Department, service, and congressional programs and initiatives. Why hasn't there been a long-term, stable funding source for MDRO-related research? Is there a need for a more coordinated and sustained research and development program (i.e., a program of record) focused on MDROs? If so, who should be responsible for it?

Dr. SMITH. There has not been long-term, stable funding for Multidrug-Resistant Organisms (MDRO)-related research because in the years immediately preceding Operation Iraqi Freedom/Operation Enduring Freedom, there was no military medical research in the area of MDROs. Military personnel who suffer combat-related injuries are at significant risk of developing acute and chronic infectious complications. Prior to 2008 and preceding Operation Iraqi Freedom/Operation Enduring Freedom, there was no military medical research in the area of MDROs.

In view of the fact that more in-depth research was required on MDROs, DOD established an intramural program of research on wound infections. In 2010 and subsequent years, the Defense Health Program (DHP) has increased funding for medical research to address wounded warrior focus areas to include wound infections. Research and development activities sponsored under the DHP represent a long-term sustainable program for preventing or inhibiting infection with MDROs.

Moving forward, the Department will ensure there is a coordinated and sustained biomedical research and development program. To address this, DOD has established the Armed Services Biomedical Research Evaluation and Management (ASBREM) Committee. The ASBREM Committee serves to facilitate coordination and prevent unnecessary duplication of effort within DOD. The ASBREM is chaired by the Director of Defense Research and Engineering and co-chaired by the Assistant Secretary of Defense for Health Affairs. The ASBREM Committee includes Senior Executive representatives from the Services, and acquisition executives. Given the establishment of ASBREM, in future, it may serve as an oversight committee for managing the research and development focused on MDROs.

Dr. SNYDER. What are the principal knowledge gaps and priorities for military research and development related to MDRO infections?

Dr. SMITH. The principle knowledge gaps and priorities for military research and development related to Multidrug-Resistant Organism infections include the following Defense Health Program-sponsored activities in basic and applied research:

Basic research in wound infection prevention and management is focused on the following knowledge gaps and priorities:

— Identification and characterization of host immune response biomarkers, particularly those predictive of infection, to aid in clinical decisionmaking (e.g., optimal wound closure time);

— Development of capabilities for early detection of antimicrobial resistance and characterization of antimicrobial resistance patterns in wound-colonizing and infecting organisms;

— Development of tools to detect and identify nosocomial pathogens; and

— Discovery of novel environmental treatments to prevent and/or eliminate pathogen contamination from military medical settings.

Basic research in antimicrobial countermeasures is focused on the following knowledge gaps and priorities:

— Identification and characterization of microbial virulence factors and other potential therapeutic targets of metabolic or signaling pathways associated with wound infection and biofilm processes;

— Identification of novel therapeutics (e.g., drugs) to mitigate wound infection and biofilm processes; and

— Discoveries applicable to polymicrobial infections and topical treatment approaches.

Applied research in wound infection prevention and management is focused on the following knowledge gaps and priorities:

— Development of an in vivo model for polytrauma/blast wound infection;

— Identification and characterization of host immune response biomarkers, particularly those predictive of infection, to support clinical wound-management decisions (e.g., optimal wound closure time);

— Development of tools for early detection of antimicrobial resistance and characterization of antimicrobial resistance patterns in wound-colonizing and infecting organisms;

— Development of tools to detect and identify nosocomial pathogens; and

— Development of novel environmental treatments to prevent and/or eliminate pathogen contamination from military medical settings.

Applied research in antimicrobial countermeasures is focused on the following knowledge gaps and priorities:

— Development of strategies to mitigate the action of microbial virulence factors and other potential therapeutic targets of metabolic or signaling pathways associated with wound infection and biofilm processes;

— Development of novel therapeutics (e.g., drugs) targeting microbial virulence factors and/or other pathway components to mitigate wound infection and biofilm processes;

— Preference is for topical treatment therapies applicable to polymicrobial infections, although novel treatment approaches are also encouraged (e.g., chelators, antibody, phage, antimicrobial peptides, quorum-sensing inhibitors, lysine, and host immunoaugmentation including antibody); and

— Preference is for projects with facile applicability for advanced development leading to Food and Drug Administration-approved products.

Dr. SNYDER. According to the Navy's statement, coordination of surveillance, treatment, and research efforts regarding infections in combat injured has taken years to develop and is only in the last year coming to fruition. Why did it take so long to achieve this level of coordination? What "lessons-learned" are being implemented to prevent future delay in similar situations?

Dr. SMITH. The question is referring to the development of TIDOS (Trauma Infectious Diseases Outcome Study) that has been developed at the Uniformed Services University's Infectious Diseases Clinical Research Program (IDCRP).

While we understand the congressional concern, the delay between recognizing the problem and initiating a new program was not a failure to achieve coordination among the Services. With the establishment of the IDCRP in 2006, seed money from the National Institute of Allergy and Infectious Diseases became available to initiate TIDOS. Shortly thereafter, IDCRP investigators were able to demonstrate the critical data that TIDOS would provide clinicians treating the war injured. Navy Medicine provided funding for TIDOS in 2009 after the program's value was properly assessed for its ability to generate evidenced based data to improve how we deliver care. Adequate funding for TIDOS has been planned through 2011.

We will continually review our efforts to fund clinical research programs to best respond to emerging needs across the enterprise.

Dr. SNYDER. DOD recently established a new research program—the Wound Infection Research Program—which was funded at about $14 million in 2010. Why is the Department only requesting about $2 million dollars for this program in 2011?

Dr. SMITH, Colonel JAFFIN, Captain MARTIN, Ms. ENGLISH, Colonel COLLIER, and Colonel FORGIONE. When DOD established the Wound Infection Research program in FY 2010, we did not have the multiyear funding option to spread the cost over multiple years. Therefore, the upfront cost in FY 2010 included two to three years' worth of medical research. The FY 2011 cost reflects smaller adjustments we need to achieve long-term research planning.

There has not been long-term, stable funding for Multidrug-Resistant Organisms (MDRO)-related research because in the years immediately preceding Operation Iraqi Freedom/Operation Enduring Freedom, there was no military medical research in the area of MDROs. Military personnel who suffer combat-related injuries are at significant risk of developing acute and chronic infectious complications. Prior to 2008 and preceding Operation Iraqi Freedom/Operation Enduring Freedom, there was no military medical research in the area of MDROs.

In view of the fact that more in-depth research was required on MDROs, DOD established an intramural program of research on wound infections. In 2010 and subsequent years, the Defense Health Program (DHP) has increased funding for medical research to address wounded warrior focus areas to include wound infections. Research and development activities sponsored under the DHP represent a long-term sustainable program for preventing or inhibiting infection with MDROs.

Moving forward, the Department will ensure there is a coordinated and sustained biomedical research and development program. To address this, DOD has established the Armed Services Biomedical Research Evaluation and Management (ASBREM) Committee. The ASBREM Committee serves to facilitate coordination and prevent unnecessary duplication of effort within DOD. The ASBREM is chaired by the Director of Defense Research and Engineering and co-chaired by the Assistant Secretary of Defense for Health Affairs. The ASBREM Committee includes Senior Executive representatives from the Services, and acquisition executives. Given the establishment of ASBREM, in future, it may serve as an oversight committee for managing the research and development focused on MDROs.

Dr. SNYDER. To what extent does the Department of Defense formally coordinate and share information with the Department of Veterans Affairs on the surveillance, prevention, and treatment of MDRO infections? How is this done?

Dr. SMITH. Currently, there are no formal coordination efforts between the DOD and VA on the surveillance, prevention, and treatment of MDRO infections. However, there are collaborative efforts underway between the Department of Defense (DOD) and Department of Veterans Affairs (VA) under the National Institute of Allergy and Infectious Diseases/Uniformed Services University Infectious Diseases Clinic Research Program which have established a long-term research protocol, entitled "Trauma Infectious Diseases Outcomes Study," to study interventions and outcomes in our combat wounded who develop multidrug-resistant organism (MDRO) infections. Patient recruitment for this protocol began in June 2009.

Dr. SNYDER. What does the Department of Defense need in order to have sufficient surveillance capabilities to identify and monitor multidrug-resistant infections throughout the military healthcare system? Should the Army's Multidrug-resistant Organism Repository and Surveillance Network (MRSN) be expanded to become a

department-wide capability? If so, what policy and resources are needed to make this happen?

Colonel HOSPENTHAL and Colonel JAFFIN. The Department of Defense should continue to maintain and strengthen established infection prevention and control policy and practice at the local military treatment facility (MTF), Service, and Department levels. Staffing and support resources along with implementing policy are needed in order to effect adequate identification and surveillance of MDRO infections throughout the military healthcare system. The Army's MRSN could be expanded throughout the Department to better coordinate and enhance MDRO surveillance, characterization, and response.

Dr. SNYDER. Shouldn't MDROs be made reportable medical events in DOD and service surveillance systems such as the Global Emerging Infections Surveillance and Response System (GEIS)? Why aren't they?

Colonel HOSPENTHAL and Colonel JAFFIN. MDRO infections are currently tracked at the individual medical treatment facility level as suggested by the Centers for Disease Control and Prevention (CDC) and other professional organizations. As opposed to other reportable diseases (e.g., cholera or measles), MDROs are an ill-defined group of organisms. If MDROs were reportable the definition of an MDRO and the diagnostic procedures would have to be constantly updated. The term MDRO is chiefly used to discuss multidrug-resistant (MDR) Gram-negative bacteria even though current CDC definitions include Gram-positive organisms (e.g., methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococcus* (VRE)). MDROs potentially include hundreds of individual species and resistance genes. Many of the resistance mechanisms can only be identified by specialized laboratory testing such as gene sequencing. Due to new resistance mechanisms and predominant bacterial species continuing to emerge, Gram-negative MDRO infections are not currently reportable events in U.S. civilian or military sectors.

Dr. SNYDER. What resources and policy are needed to provide military treatment facilities, particularly those in deployed areas, adequate standardized laboratory testing capabilities to identify and characterize MDROs?

Colonel HOSPENTHAL and Colonel JAFFIN. Most military medical treatment facilities (MTF) outside of the combat zones have adequate capabilities to identify and characterize MDROs. The larger deployed MTFs have been provided clinical microbiology assets and equipment.

Dr. SNYDER. Since the outbreak of MDRO infections, what additional infection control and prevention training and education do medical personnel in deployed military treatment facilities receive? Please describe the nature and extent of the training, what personnel are required to take it, and where and how often it is provided. Are there plans to expand infection control training and education?

Colonel HOSPENTHAL and Colonel JAFFIN. Additional infection control training was added to the Joint Forces Combat Trauma Management Course at Fort Sam Houston, Texas. This training is provided to personnel staffing level III deployed medical treatment facilities such as the Army's Combat Support Hospitals (CSHs). Additionally, a 5-day short course was established to train Infection Control Officers who are responsible for infection control programs within these hospitals. Because a single CSH may split to operate in multiple locations, a September 2010 Army Execute Order requires the CSH to assign an Infection Control Officer at each location that provides inpatient care.

Dr. SNYDER. Do all deployed military treatment facilities have trained and qualified infection control officers? If not, why? What policy or resources are needed to ensure there is not a shortage of military healthcare personnel trained and experienced in infection control?

Colonel HOSPENTHAL and Colonel JAFFIN. Reviews of the combat theater hospitals in 2008 and 2009 found that not all had trained and qualified infection control officers (ICO). There is a shortage of personnel trained and qualified to serve as ICOs at all deployed medical treatment facilities (MTF). To remedy the shortage of qualified ICOs, a 5-day short course was established to train personnel who are responsible for infection control programs and have been identified to serve as Infection Control Officers at the CSH. Because a single CSH may split to operate in multiple locations, a September 2010 Army Execute Order requires the CSH to assign an Infection Control Officer at each location that provides inpatient care. Department of Defense staffing policy should be revised to require trained and qualified ICOs at all level III deployed MTFs (i.e., deployed hospitals).

Dr. SNYDER. According to the Army's statement, critical reviews of infection control practices and challenges in combat theater hospitals were conducted in 2008 and 2009, which led to improved infection control efforts. Are there plans to conduct such reviews on a regular basis in the future? If so, who will conduct these reviews,

how often will they be conducted, and where will the results be reported to? If not, what policy and resources are needed to establish this process?

Colonel HOSPENTHAL and Colonel JAFFIN. These reviews have been and continue to be planned and conducted ad hoc by the Infectious Disease and Infection Control Consultants to the U.S. Army Surgeon General with the support of the U.S. Central Command (CENTCOM) Surgeon. The informal plan is to continue these reviews on an annual basis with results communicated to the CENTCOM Surgeon, the three Services Surgeons General offices, and through presentations and publications to deploying healthcare providers. These reviews will be conducted on a routine and regular basis, ideally in conjunction with standardized theater infection control practices and establishment of an infection control theater consultant.

Dr. SNYDER. What are the principal knowledge gaps and priorities for military research and development related to MDRO infections?

Colonel HOSPENTHAL and Colonel JAFFIN. For military research and development related to MDRO infections, principal knowledge gaps existed in diagnostic and treatment products and programs have been established to mitigate these gaps. Principal research priorities focus on addressing knowledge gaps in addition to research on prevention strategies and technologies. Programs established to address these knowledge gaps and priorities include the Military Infectious Diseases Research Program—Wound (MIDRP–W) and the Infections Diseases Clinical Research Program (IDCRP). The MIDRP–W focuses on wound infection research. The IDCRP, a joint program between Department of Defense (DOD) and National Institutes of Health, focuses on the design, conduct and publishing of collaborative clinical infectious disease research of importance to the DOD and the National Institutes of Allergy and Infectious Diseases through an effective research network that rapidly responds to evolving infectious disease threats.

Dr. SNYDER. According to the Navy's statement, coordination of surveillance, treatment, and research efforts regarding infections in combat injured has taken years to develop and is only in the last year coming to fruition. Why did it take so long to achieve this level of coordination? What "lessons-learned" are being implemented to prevent future delay in similar situations?

Colonel HOSPENTHAL and Colonel JAFFIN. Since multidrug-resistant *Acinetobacter* were first discovered as infecting patients on the United States Naval Ship *Comfort* at the start of Operation Iraqi Freedom, several ad hoc groups have helped to coordinate the Department of Defense response to MDROs. This initial discovery and identification did not include all MDROs, only *Acinetobacter.* The work and coordination of these ad hoc groups have grown over the subsequent years to what exists today. Implemented lessons learned include the rapid identification and assessment of the class of infection along with rapid dissemination of findings to other services and Department of Defense infectious disease oversight organizations.

Dr. SNYDER. What does the Department of Defense need in order to have sufficient surveillance capabilities to identify and monitor multidrug-resistant infections throughout the military healthcare system? Should the Army's Multidrug-resistant Organism Repository and Surveillance Network (MRSN) be expanded to become a department-wide capability? If so, what policy and resources are needed to make this happen?

Captain MARTIN and Ms. ENGLISH. The collection of Multidrug-resistant Organisms (MDROs) specimens from the National Naval Medical Center Bethesda for the MRSN is already occurring and could be expanded to other Navy military treatment facilities (MTFs). Most Navy MTFs have an MDRO identification and surveillance capability and the Navy and Marine Corps Public Health Center (NMCPHC) is expanding the central monitoring of CHCS (Composite Health Care System) laboratory input to eventually include all Navy MTFs.

Dr. SNYDER. Shouldn't MDROs be made reportable medical events in DOD and service surveillance systems such as the Global Emerging Infections Surveillance and Response System (GEIS)? Why aren't they?

Captain MARTIN and Ms. ENGLISH. No, the Centers for Disease Control and Prevention (CDC) have not recommended tracking MDROs in this manner. Diseases that are reportable are connected to individual patients whereas MDRO isolates may be from clinical specimens, colonization surveillance, environmental samples.

Data regarding the resistance profiles of bacteria are best gathered in an antibiogram (spreadsheet describing the antibiotic susceptibility of bacteria from a facility's microbiology lab that is updated periodically). Collection and review of the data from Navy MTFs on a regular basis allows for MDROs to be tracked more effectively. The Navy and Marine Corps Public Health Center (NMCPHC) is tracking the resistance profiles of bacteria at Navy hospitals electronically by collecting data from the laboratory computer input into CHCS (Composite Health Care System).

Dr. SNYDER. What resources and policy are needed to provide military treatment facilities, particularly those in deployed areas, adequate standardized laboratory testing capabilities to identify and characterize MDROs?

Captain MARTIN and Ms. ENGLISH. Much of the initial identification of MDROs can be performed with standard microbiology techniques (with the addition of some commercially available test strips) and does not require high-tech capacity. The ability to provide reliable data regarding MDROs in the deployed areas requires a basic microbiology laboratory, not only with the basic capabilities currently in place, but also a trained microbiologist/micro lab tech to interpret the laboratory data and guide further testing.

The provision of even a basic microbiology in a far forward-deployed setting is often not possible. In these cases, identification of MDROs could also be achieved by shipping the MDRO suspect isolates on to Landstuhl Regional Medical Center or CONUS facilities where these organisms can be more reliably evaluated.

Fully characterizing MDROs requires highly advanced laboratory abilities and could not be done in the deployed setting and is best performed at a centralized site such as that functioning with the Multidrug-resistant Organism Repository and Surveillance Network (MRSN).

Dr. SNYDER. Since the outbreak of MDRO infections, what additional infection control and prevention training and education do medical personnel in deployed military treatment facilities receive? Please describe the nature and extent of the training, what personnel are required to take it, and where and how often it is provided. Are there plans to expand infection control training and education?

Captain MARTIN and Ms. ENGLISH. Infection Control is a universal part of the training of all medical, dental and nurse corps officers as well as hospital corpsmen. The Navy does not require special training in infection control and has no specialized prevention training specifically for those deployed, but does have several programs to train Infection Preventionists (IPs). We have reemphasized basic infection control in the deployed military treatment facilities and requests for additional training, as needed, are strongly encouraged.

IPs in charge of infection prevention and control programs must receive documented education in basic concepts of infection surveillance, prevention, and control from an accredited program providing continuing education credits. Navy Medicine holds monthly video teleconference/digital conference online (VTC/DCO) meetings hosted by the BUMED Infection Control Consultant. These sessions are offered to all medical treatment facility/dental treatment facility (MTF/DTF) IPs. They provide education on infection prevention/control topics as well as updates related to current literature and Joint Commission surveys.

Additionally, each MTF/DTF is encouraged to send IPs to current, up-to-date courses. Examples include: EPI 101 (Fundamentals of Infection Surveillance, Prevention and Control) courses by Association for Professionals in Infection Control and Epidemiology (APIC); Courses in Healthcare Epidemiology cosponsored by the Society for Healthcare Epidemiology of America and the Centers for Disease Control and Prevention (SHEA/CDC); Annual Fellows Course in Hospital Epidemiology and Infection Control at the Johns Hopkins Hospital in Baltimore, Maryland; the Statewide Program for Infection Control and Epidemiology (SPICE) at the University of North Carolina at Chapel Hill.

Dr. SNYDER. Do all deployed military treatment facilities have trained and qualified infection control officers? If not, why? What policy or resources are needed to ensure there is not a shortage of military healthcare personnel trained and experienced in infection control?

Captain MARTIN and Ms. ENGLISH. All Medical, Dental, and Nurse Corps officers along with enlisted Hospital Corpsmen have training in infection control and infection control has been re-emphasized in all Navy facilities as the increase in Multi-Drug Resistance Organisms (MDROs) has occurred. There is not a specific designation for infection control officers in the Navy. Military treatment facilities in deployed settings assign a medical department officer to be responsible for infection control. The hospital ships USNS *Comfort* and USNS *Mercy*, each have assigned infectious diseases staff who are subject matter experts in infection control, and other ships with a large medical department may also deploy with an infectious diseases physician.

The Navy has not experienced a shortage of military healthcare personnel trained and experienced in infection control.

Dr. SNYDER. According to the Army's statement, critical reviews of infection control practices and challenges in combat theater hospitals were conducted in 2008 and 2009, which led to improved infection control efforts. Are there plans to conduct such reviews on a regular basis in the future? If so, who will conduct these reviews,

how often will they be conducted, and where will the results be reported to? If not, what policy and resources are needed to establish this process?

Captain MARTIN and Ms. ENGLISH. We are continually working to improve how we deliver healthcare in all our medical facilities. Continuously reviewing and revising how we do business helps us ensure we are evaluating and implementing best clinical practices. The Army's recent review of Infectious Disease and Infection Control was a good example of how we have learned and adapted to conditions in-theater. It was evident from the review that there was a need to reemphasize basic infection control practices. This approach has had a positive impact for not only our patients in-theater, but also for those in CONUS. In addition to our renewed emphasis on basic infection control, the Navy and Marine Corps Public Health Center (NMCPHC) is electronically tracking the resistance profiles of bacteria at Navy Military Treatment Facilities. Navy Medicine will continue to conduct additional reviews as appropriate and in collaboration with our partners in-theater.

Dr. SNYDER. What are the principal knowledge gaps and priorities for military research and development related to MDRO infections?

Captain MARTIN and Ms. ENGLISH. The principal gap in MDRO-related research is the lack of available drugs in the development pipeline to effectively treat these infections. This problem is not specific to the military as it affects civilian facilities worldwide. The need for an international focus on development of new drugs for these infections is outside the research capabilities in the U.S. military at this time. The military has chosen to focus its intramural research efforts on areas of specific concern for clinical care of the injured warfighter.

The Navy has focused funding on the clinical aspects of MDRO infections in war injuries. The two focus areas are:

1. Developing enhanced surveillance and electronic reporting from Navy laboratories of MDROs to determine the source of these organisms and minimize their acquisition and spread among patients and staff.
2. Assessing what treatment and management strategies for wound infections with MDROs are associated with the best outcomes through the TIDOS (Trauma Infectious Disease Outcome Study).

Dr. SNYDER. According to the Navy's statement, coordination of surveillance, treatment, and research efforts regarding infections in combat injured has taken years to develop and is only in the last year coming to fruition. Why did it take so long to achieve this level of coordination? What "lessons-learned" are being implemented to prevent future delay in similar situations?

Captain MARTIN and Ms. ENGLISH. The question is referring to the development of TIDOS (Trauma Infectious Diseases Outcome Study) that has been developed at the Uniformed Services University's Infectious Diseases Clinical Research Program (IDCRP).

With the establishment of the IDCRP in 2006, seed money from the National Institute of Allergy and Infectious Diseases (NIAID) became available to initiate TIDOS. Shortly thereafter, IDCRP investigators were able to demonstrate the critical data that TIDOS would provide clinicians treating the war injured. Navy Medicine provided funding for TIDOS in 2009 after the program's value was properly assessed for its ability to generate evidenced based data to improve how we deliver care. Adequate funding for TIDOS has been planned through 2011.

The delay between recognizing the problem and initiating a new program was not a failure to achieve coordination among the Services. Navy Medicine has a strong working relationship with the Army and Air Force in the area of infection control. Our efforts to uncover the Multidrug-Resistant Organism problem were successful and subsequent efforts to fund clinical research programs have been addressed. Navy Medicine is currently funding TIDOS and is continuously reviewing priorities to best respond to emerging needs across the enterprise.

Dr. SNYDER. What does the Department of Defense need in order to have sufficient surveillance capabilities to identify and monitor multidrug-resistant infections throughout the military healthcare system? Should the Army's Multidrug-resistant Organism Repository and Surveillance Network (MRSN) be expanded to become a department-wide capability? If so, what policy and resources are needed to make this happen?

Colonel COLLIER and Colonel FORGIONE. Expansion of the Army's MSRN to become a DOD-wide program would provide sufficient surveillance to identify and monitor these infections. We would work with the Army to determine what resources would be needed to make this a reality.

Dr. SNYDER. Shouldn't MDROs be made reportable medical events in DOD and service surveillance systems such as the Global Emerging Infections Surveillance and Response System (GEIS)? Why aren't they?

Colonel COLLIER and Colonel FORGIONE. The CDC's National Healthcare Safety Network and The Joint Commission requires programs to track and control healthcare-associated infections (from catheters, ventilators, etc.) and has specific definitions for methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococcus* (VRE), Gram-positive infections. Certain MDROs are not reported due to their diverse species and broad range of resistance mechanisms; these make them complex to characterize. While mandatory reporting of Multidrug-Resistant Organisms (MDROs) across the DOD would be challenging to establish and maintain, such a program would allow for coordinated surveillance and response. The first step will be to define which MDROs will be tracked.

GEIS has supported the clinical laboratories that perform MDRO screening for our four major military medical centers who receive combat-wounded U.S. personnel using funds within the currently established current screening program. A DOD program as suggested in question one could potentially improve oversight in reporting MDROs across the DOD. GEIS focuses predominantly on emerging infections overseas.

Dr. SNYDER. What resources and policy are needed to provide military treatment facilities, particularly those in deployed areas, adequate standardized laboratory testing capabilities to identify and characterize MDROs?

Colonel COLLIER and Colonel FORGIONE. USAF military medical treatment facilities (MTF) outside of the deployed areas are adequately equipped and staffed to perform bacterial identification and antibiotic sensitivities; emerging Multidrug-Resistant Organisms (MDROs) will be referred to designated DOD referral labs for advanced testing and characterization. Larger deployed MTFs should receive supplemental clinical microbiology assets and equipment. A DOD program policy to standardize deployed clinical microbiology assets would enhance surveillance and is essential to standardized analysis, interpretation and reporting of emerging MDROs.

Dr. SNYDER. Since the outbreak of MDRO infections, what additional infection control and prevention training and education do medical personnel in deployed military treatment facilities receive? Please describe the nature and extent of the training, what personnel are required to take it, and where and how often it is provided. Are there plans to expand infection control training and education?

Colonel COLLIER and Colonel FORGIONE. All USAF medics receive annual training in infection control (IC) practices and principles as part of their normal duty assignment. Medics identified to deploy receive refresher IC training at various training courses (i.e. EMEDS, CCAT, etc). Individuals identified to deploy as the infection control officer are required to complete the 5-day Infection Control Course. Also there is a specific joint course available: "Infection Control in the Deployed Setting," which deploying IC officers are required to take. There are no plans to expand these requirements.

Dr. SNYDER. Do all deployed military treatment facilities have trained and qualified infection control officers? If not, why? What policy or resources are needed to ensure there is not a shortage of military healthcare personnel trained and experienced in infection control?

Colonel COLLIER and Colonel FORGIONE. Yes, the USAF provides an officer who has completed the infection control basic course to manage infection control at Expeditionary Medical Support (EMEDS) facilities.

Dr. SNYDER. According to the Army's statement, critical reviews of infection control practices and challenges in combat theater hospitals were conducted in 2008 and 2009, which led to improved infection control efforts. Are there plans to conduct such reviews on a regular basis in the future? If so, who will conduct these reviews, how often will they be conducted, and where will the results be reported to? If not, what policy and resources are needed to establish this process?

Colonel COLLIER and Colonel FORGIONE. According to the Army Infectious Disease (ID) Consultant there are no formal plans for regular reviews of the infection control practices and challenges in deployed level III medical treatment facilities (MTF), but plans are currently underway for a review of the Afghan theater operations in winter of 2011 by the Army ID Consultant. The USAF has no plans to conduct a theater review in the coming year. We agree that there is a need to conduct routine and regular reviews, and support a joint team concept, using standardized theater infection control practices. The Air Force Surgeon General is working to have AFIA, our inspection agency, review infection control practices and outcomes at our hardened, sustained, MTFs in theater.

Dr. SNYDER. What are the principal knowledge gaps and priorities for military research and development related to MDRO infections?

Colonel COLLIER and Colonel FORGIONE. The Joint Program Committee-2 (JPC–2) used Fiscal Year 2010 Defense Health Program e-funds for approximately 32 Multidrug-Resistant Organisms (MDRO)-focused research projects in five DOD lab-

oratories, in five civilian university laboratories, and in four companies in the commercial sector. The Military Infectious Diseases Research Program (MIDRP)/JPC2 current gaps for MDROs are:

a. Wound Infection Prevention & Management: Fundamental research to prevent infections and inform clinical wound management.
b. Antimicrobial Countermeasures: Fundamental research for discovery of tools to treat MDRO wound infections.
c. Wound Infection Prevention & Management: Applied research for development of tools to prevent wound infection and inform clinical wound management.

Dr. SNYDER. According to the Navy's statement, coordination of surveillance, treatment, and research efforts regarding infections in combat injured has taken years to develop and is only in the last year coming to fruition. Why did it take so long to achieve this level of coordination? What "lessons-learned" are being implemented to prevent future delay in similar situations?

Colonel COLLIER and Colonel FORGIONE. There was coordination initially at the level of the infectious diseases specialists from the time the problem was identified initially on the USNS *Comfort* at the start of the Iraqi War in 2003 and the three services mobilized to tackle this challenging problem. Over the last seven years and despite the absence of a central coordinating body, the services created a relatively robust response to the issues despite the challenges outlined in these questions and our previous testimony. The infrastructure and research initiatives initiated to date laid the groundwork upon which we may build a more vigorous and improved DOD response in 2010 and beyond.

The Air Force Medical Service has not been faced with many patients with Multidrug-Resistant Organism (MDRO) infections; so, as a service, the issue has not required significant resources. However, our significant participation in transporting wounded joint/coalition patients via the patient movement system (Air Evacuation and through our theater hospitals (Balad, Bagram)) and the guarantee that we will be similarly involved in future conflicts mean we must join the joint effort to address MDROs. To that end, we will continue to place competent and trained infection control officers at our Military Treatment Facilities and we support making the Army's Multidrug-Resistant Organism Repository and Surveillance Network (MRSN) a DOD program and the use of the Global Emerging Infectious Surveillance and Response System (GEIS) as a database to track and analyze MDRO infections.